

SIXTY-EIGHTH YEAR

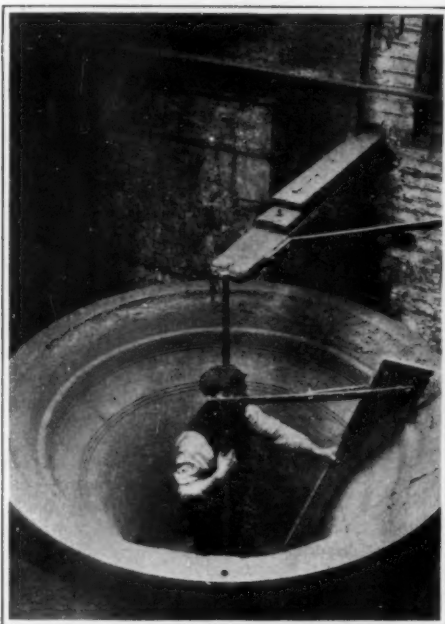
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

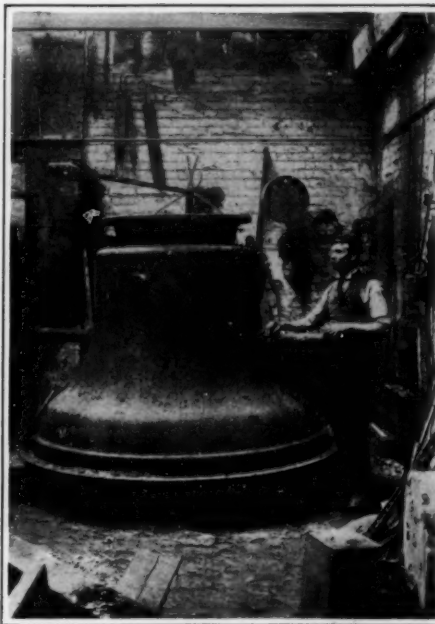
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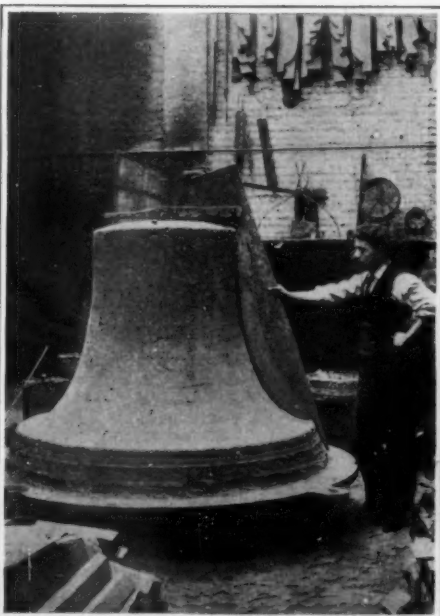
Molding the outer case of the mold. The first step is the building of the mold, the most vital step in the evolution of the bell. A blunder here might mean so dismal a failure that the ordeal of casting would have to be repeated.



The mold of the bell complete and the outer case fitted over the core. For the purpose of securing uniformity of shape and thickness, the two sections of the mold should precisely correspond with each other.



The core is coated with loam, smoothed with a delicately adjusted crook or template, worked on a pivot, and then thoroughly dried. Then an iron hood is used to form the outer side of a future "Great Peter."



The core of the bell complete. This task concludes the difficult operation which forms the shape and the dimensions of the inner side of the structure, and is an important feature of the work.



Core in the pit. Drying the mold. At the bottom of this deep pit, under the mouth of the furnace, the workmen brick up a structure called the "core." This work forms the shape and dimensions of the inner side of the bell.



The bell, on being transferred to the tuning shop, is tuned in the machine shown and designed for the purpose. This operation completes the greatest revolution in the bell world, as prior to it the bell was nearly always out of tune.

HOW BELLS ARE MADE.—[See page 238.]

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The Editor is always glad to receive for examination illustrated
articles on subjects of timely interest. If the photographs are *short*,
the articles *short*, and the facts *authentic*, the contributions will
receive special attention. Accepted articles will be paid for at
regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Discovery of the South Pole

IT is much too early to give any critical account of Capt. Roald Amundsen's achievement. Many weeks must elapse before we are in complete possession of all his data. Yet even the laconic account, which he has cabled to the press, throws a flood of light on the mystery of Antarctic geography.

Amundsen seems to have collected enough evidence to substantiate the theory that the great chain of mountains which extends almost uninterruptedly from Alaska to Patagonia finds its continuation in a ridge connecting Victoria Land and King Edward VII Land, and which, in honor of his queen, he has named "Queen Maude's Range." The ice barrier, which had proved for a century and a half a formidable obstacle to Antarctic exploration, is found to terminate in a bay, lying between the southeast mountain range running from South Victoria Land and a range which is probably a continuation of King Edward the VII Land and which extends in a southwesterly direction. Contrary to his original plan, Amundsen despatched one of his officers, Lieut. Prestud, to survey the Bay of Whales and the great ice barrier and to explore King Edward VII Land, of which practically nothing is known.

No doubt the spur of competition played its part in unfolding the secrets of the last unexplored frigid region of the earth. No less than four other expeditions were in the Antarctic regions at the time when Amundsen was forcing his way south. Besides Amundsen's, there was the Japanese expedition under Lieut. Shirase, which had to retreat to Australia last spring in order to replenish its supply of dogs, and which Amundsen says landed on January 16th at the Bay of Whales, two weeks before he sailed for home; Dr. Mawson's Australian expedition, for which \$215,000 had been raised up to November 1st last, and which was to land three parties between Cape Adare and Gaussberg; the German expedition under Lieut. Filchner in the "Deutschland," elaborately equipped with wireless, magnetic, and meteorological apparatus, full of the hope of establishing a base southwest of Coats Land in as high a latitude as possible; and lastly, Capt. Scott's English expedition in the "Terra Nova," which left New Zealand in November, 1910, badly damaged by stormy weather; so badly, indeed, that the necessary repairs and the cost of making good the stores that had been lost seriously depleted the resources of the party.

Amundsen seems to have been helped by exceptionally favorable weather conditions. To be sure, there were storms, but not those frightful hurricanes which thwarted Shackleton. It was cold, so cold that the dogs suffered visibly; yet the average temperature was no lower than that in many an inhabited part of Canada. Amundsen himself states that part of his journey was much like a pleasure trip—"excellent ground, fine sledging, and an even temperature." The glaciers and crevasses make detours necessary, yet, despite them, progress was remarkably rapid. The party climbed up 2,000 to 5,000 feet in a day.

Throughout much of his journey Amundsen con-

ced entirely new ground. Therefore he will bring back absolutely new information of Antarctic geography. He made up his mind that he would reach the plateau on which the Pole is situated by another route than that of Beardmore Glacier. Luck, instinct, experience, call it what you will, the new route proved easier than that which either Shackleton or Scott took on their expeditions. To that comparatively easy route, coupled with exceptionally favorable weather, may be attributed Amundsen's success.

Object Lessons in Road Building

PROBABLY the most effective agencies in promoting the good roads movement in the United States are the object lessons in the construction and upkeep of roads which are afforded, independently, by the federal Office of Public Roads and by the public-spirited munificence of a leading citizen of the State of Delaware. Each enterprise forms the subject of a separate article in this issue, and we commend them to the careful consideration of everyone who has the vital subject of good roads at heart.

If the provision of first-class highways be an indispensable condition to the full development of a country, the du Pont Road, built on the most approved plans and shortly to be opened for traffic cannot fail to promote the value and productivity of farm lands, not merely of those contiguous to the road, but throughout a wide belt of country which will be tributary to it by means of country road feeders. Moreover, the system of careful maintenance and cost-keeping which is to be enforced, will provide greatly-needed data as to the relative efficiency and cost of the different systems of roadbuilding which are being laid down.

Even more valuable, because of the wider geographical range of its experimental work, are the data which are being obtained by the Office of Public Roads, which aims to do for the whole United States what Mr. du Pont is doing for his native State.

The value of demonstrational work can be better understood when we consider how greatly the problems which confront the road builder vary with local conditions. Instructions in the art of road building, in order to be of real practical value, must be adapted to the peculiar conditions of each locality. The government has found that such instruction can best be given through the medium of object-lesson roads, built at local expense under the supervision of the office. During the past fiscal year fifty-two such roads were constructed in various portions of the United States. Each of these demonstrations was in effect a practical school in applied road building, especially adapted to solve the local problems involved.

Another line of work which is productive of even greater good is what the Office terms the model system. Instead of dealing with one short piece of road, the county is treated as a unit. A comprehensive study is made of the entire road system of the county as to classification, location, materials, maintenance and administration. A practical working scheme for present and future operation is then drawn up and given to the proper authorities. During the past fiscal year fourteen studies of that kind were made in eight different States. Much experimental work is also being carried on in order to determine the value of new materials and different methods of construction and maintenance.

The road materials testing laboratories maintained by the Office are the equal of any in the world. Routine tests have been standardized and the government standards have been largely adopted all over the country. Any citizen may have proposed road materials tested free of charge by sending a standard sample, express prepaid, and complying with a few simple requirements.

It is evident that, in a work so large and varied as the construction and maintenance of our public roads, many mistakes will be made and much time and money squandered, largely through ignorance and lack of experience. One of the most fruitful lines of work carried on by the Office of Public Roads has been directed toward the prevention of this waste.

Federal Control of Water Power

WE publish on the Correspondence Page of this issue a letter from a correspondent at the University of Idaho, which contains some stringent criticisms of a series of articles written by Dr. McGee of Washington, on the principles of water power development. Incidentally, the letter attacks the present policy of the federal government in controlling the development of water power, particularly in the middle and

far west. If we interpret our correspondent's letter aright he is opposed to federal regulation of the use of water power on public lands, and he would have this matter left entirely to the control of the several State Legislatures. Now we are free to confess that the attitude and work of the federal government in this direction has always seemed to us perfectly correct and eminently beneficial. However, after receiving this letter, we again read the two articles of Dr. McGee, which will be found in the SUPPLEMENTS of February 3rd and 10th, 1912, and we have to confess that our belief in federal control is rather strengthened than otherwise.

As we understand it, the federal government has taken hold of this matter of water supply, on the ground that it is only by working on a broad plan and substituting a single co-ordinated effort for the hitherto disjointed and individualistic enterprises of States or corporations or individuals, that the most economic development of water supply can be secured, and the best interests of the largest number of people effectually promoted. When the government engineers began their investigation, it was found that the plans for the development of water supply for irrigation and power purposes had been drawn mainly with a view to securing as large and as quick returns as possible to the irrigating and power companies, or the largest amount of benefit to the particular localities served by the various enterprises—all of this work being done without much, if any, attempt at co-ordination with a view to securing the best possible results for the greatest number of people and over the largest area of country served by the various rivers and streams.

Now we believe that any one who will carefully and without prejudice study the work that has already been done by the federal government will be convinced that the work already accomplished and that which has been planned for the future, provides for a more equitable and a technically much more efficient development of the water power of the country than could ever be hoped for under the system which prevailed before the commission took hold of this matter upon the broad national lines which are being followed to-day with such excellent results.

Utilizing the Surplus Potatoes

AN overproduction of potatoes in Germany in recent years has led the industrial community of that country to make great efforts to devise means of utilizing the surplus of the crop. This problem is being solved successfully in two ways; first by stimulating the use of potato spirits as a fuel and illuminant, and second by a great extension of the various processes of drying potatoes, for use both as a food and in the arts.

According to a recent consular report, there are now 436 plants established in Germany for drying potatoes, with an estimated annual production of 110,230 to 165,345 short tons, or 3,674,000 to 5,511,500 bushels. Of these plants, 350 are for the production of potato flakes, while in 86 the potatoes are dried by the hot-air process. Potato flakes can be used for feeding stock, for distilling alcohol, for making starch, and for the other purposes for which natural potatoes are used; or they can be ground and bolted to make potato flour. This flour is a yellowish-white product, rich in carbohydrates, and is used principally by bakers for adding to rye and wheat flour in making bread. It is claimed that the addition of potato flour gives the bread a good flavor, makes it more digestible, and keeps it fresh for a comparatively long time. It is also used to some extent in thickening soups and sauces. The potato flour industry has also assumed large proportions latterly in the Netherlands, most of the factories being in the Province of Groningen. The same country disposes of its surplus potatoes to a large extent in the manufacture of dextrine.

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Engineering

Slides in Culebra Cut.—It is estimated that there remains to be excavated from Culebra cut on account of slides 4,300,000 cubic yards of material, or about 28 per cent of the total excavation remaining to be done in this section. At the present writing the cut is about 86 per cent completed.

Our Railroads Kill 10,000 a Year.—Recent statistics published by the Interstate Commerce Commission show that during the year ending June 30th, 1911, nearly 10,000 people were killed on our railroads and over 70,000 were injured. It should be borne in mind that 5,284 of the killed and 5,614 of the injured were trespassers, and presumably the blame for their deaths is chargeable to themselves and not to the railroads.

Our First Diesel-engine Submarines.—Our two latest submarines, E-1 and E-2, have two features of novelty, namely, that the motive power consists of Diesel engines, of 520 horse-power, and that the vessels are fitted with a form of folding masts, which reach 30 feet above the deck and will form part of a wireless outfit. The vessels are 135 feet long and each carries four torpedo tubes. As 5,000 gallons of fuel oil can be stored, the vessels will have a wide radius of action.

The Jungfrau Railway.—The recent completion of the Jungfrau Railway tunnel has drawn attention to that striking work of engineering, the Jungfrau Railway, which, on its completion, will be the highest railway in Europe. The final station will be built at an elevation of 2,000 feet above the present end of the line, and from the station, which will be cut out of the solid rock, an elevator will carry passengers 240 feet to the summit of the Jungfrau, which stands at an elevation of 13,669 feet.

The Quebec Bridge Wreck.—The recent attempt to revive the discussion of the cause of the Quebec Bridge wreck by ascribing it to dynamiters of the Los Angeles type is altogether foolish and without any foundation of fact. The bridge fell because its details were improperly designed. The web plates of which the bottom compression member was composed were insufficiently latticed together and the latticing tore asunder, permitting the posts to crumple up under a load less than it was intended to carry, and drop the whole bridge into the river.

Activity at the Shipbuilding Yards.—According to the *Shipping Journal* there is a scarcity of shipping throughout the world, and this in spite of the fact that last year the British shipyards alone turned out over 1,750,000 tons of new shipping. *The Shipping World* is of the opinion that there must have been a very marked forward move in the world's trade. It is lamentable that in the midst of this prosperity the United States should be willing to pay out \$300,000,000 a year for the transport of freight which might just as well be carried by ships built in its own shipyards.

Public Service Commission Activities.—There are probably no municipal bodies which come so closely into touch with engineering as the Public Service Commission of this State. The magnitude of the interests covered by the Commission is shown in a recent return for the Second District, from which we learn that it has jurisdiction over more than one thousand corporations, whose capitalization totals over four and a half billion dollars. During the past year the Commission has held 572 public hearings, covering 2,321 questions, and the number of days occupied in hearings reached a total of 285.

Marking Time.—It would be difficult to find a question of National policy which is so little understood as that of the increase of our navy. People who are crying out against the vast increase of our armaments evidently do not understand that the addition of two battleships a year (our present programme) simply represents a policy of marking time. It would take the four battleships a year recommended by the Naval Board to improve our standing among the leading naval powers. The addition of two battleships a year merely enables us to keep our fighting line at its present strength; for it is a fact that every year some of our early battleships become obsolete.

The "Olympic" in Trouble Again.—For the third time the world's biggest steamship, the "Olympic," has met with serious accident. Not many months ago she sucked a cruiser which she was passing into her starboard quarter, with the result that many feet of her plating were ripped out both above and below the water line. She was repaired, and at the second or third voyage thereafter she struck a derelict and injured her propeller. She steamed into drydock and had the propeller replaced, and on leaving the drydock she struck bottom and had to be returned for a further examination. All this is a mere matter of coincidence, and the three disasters are entirely unrelated as to their immediate causes. But what will the superstitious have to say?

Electricity

Warming Bears with Electricity.—An unexpected use of electric heating radiators in New York city during the excessively cold weather of the present winter has been to warm the bear caves in the Bronx Park Zoo. The distance from the power house made it inconvenient to pipe steam to these dens, but the electric heaters have kept Bruin warm.

Ultra-violet Rays in Submarines.—At a recent meeting of the Comparative Pathology Society at Paris, M. Daniel Berthelot brought out the fact that ultra-violet rays could be used for purifying the air in submarine boats. Such rays are produced in great quantities by the quartz mercury vapor lamp and their sterilizing power is now well known. The secret of the great power of the ultra-violet rays is simple, according to him, for they correspond to the highest temperatures that we know. In fact the temperature of the mercury vapor lamp which produces them is even higher than that of the sun. He mentions also an interesting point, that is, if we expose to the rays a mixture of carbonic acid gas and ammonia, they combine and give rise to formic amide, which is the base of protoplasm and living matter.

The Motor in Building Construction.—The versatility of the electric motor is well exemplified in examining the present-day conduct of a single industry, that of building construction. The stronghold of the modern, efficient electric motor for the temporary installation required in building is found in the saving of time in installing (and if necessary relocating) the motor, simplicity of running the wires, simplicity and economy of the operation of the motors, the absence of soot, smoke, ashes, and dust, or the freezing of steam and water pipes, or fire hazards from sparks or live coals. The appliances include motor-driven swing and cut-off saws and other woodworking machines, concrete mixers, hoists for brick, mortar, fabricated steel, and the other building materials, air compressors for pneumatic riveters and caisson work, and pumps. Small locomotives or motor-driven cableways are also employed where there is much excavation to do.

The Electric Business Vehicle.—The actual and growing interest in electric business vehicles is being fostered by the electricity supply companies in many cities. In Boston, Mass., and Newark, N. J., money is at present being spent freely to push the sale of these vehicles, and a recently published list of express companies, department stores, brewers, manufacturers and other industrial concerns shows an aggregate investment of about \$5,000,000 in electric storage battery trucks and delivery wagons, in operation and on order. The public service companies selling electricity are especially heavy users of this form of transportation. Municipal utilization includes street cleaning and garbage removal, fire trucks, police patrol and service wagons. One of the most conservative central stations in the East predicts that more current will soon be sold for the charging of electric vehicle batteries than is now being sold for light.

Thawing Frozen Water Pipes.—Since the discovery that frozen water pipes could be thawed out by passing a rather heavy current of electricity through them from the nearest electric light mains, this neat method of reaching a literally "deep seated" trouble has had increasing application. An electric light company of New York city has recently been kept very busy on this winter work, utilizing as many as five trucks equipped with the special apparatus required for the thawing work. Over four hundred "cases," for the most part pipes under one inch in size, have been handled in a single week. The average time for the current to do its work has been about thirty minutes. Where a convenient connection can be made to the electric light main a water rheostat is employed to control the strength of current, but in the absence of such opportunity for direct connection with the power house energy, a portable storage battery is used.

Guided Radio-telegraphy.—Experiments with Major Squier's system of employing telephone and telegraph wires to guide Hertzian waves were recently made between the Bureau of Standards, in Washington, and the New York office of the Postal Telegraph Cable Company. The object of these experiments was to determine the best frequencies for long distances. It was found that frequencies of from 10,000 to 25,000 cycles per second would serve best for long distance transmission, while frequencies ranging from 25,000 to 100,000 cycles would be used on shorter circuits. Various methods of connecting the transmitters and receivers to the line were tested. Inductive coupling was found to give the best results, and was more flexible, for it permitted the operation of a number of lines from a single generator. It was shown conclusively that guided radio-telegraphy was far more economical in the consumption of power than free radio-telegraphy.

Aeronautics

The Italian Campaign.—The events in Tripoli have shown that in the next great European war the flying machine must be reckoned with. The Italian commander knows as much about the position and strength of the Turkish forces as the Turks themselves.

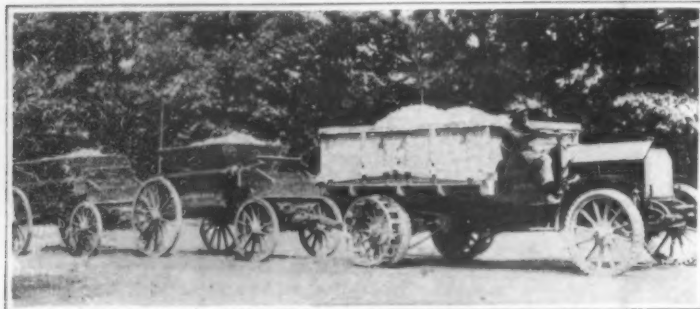
A Postal Aeroplane Service in Germany.—In view of the recent request of Assistant Postmaster-General Britt to Congress for an appropriation of \$50,000 for an experimental aeroplane mail service, it is interesting to note that a regular postal service of this kind has lately been established in Germany. The service is maintained between Cologne, Düsseldorf, and Neuss, and four aviators are regularly employed to carry the mail daily. Now that an actual aeroplane mail service is in operation, it would seem that Congress should appropriate money for experiments of this kind in the United States, just as it is doing for experiments in the delivery of mail by automobiles.

Successful Parachute Drop from an Aeroplane in Flight.—The first attempt that has ever been made to drop from an aeroplane in a parachute occurred at St. Louis on March 1st. When flying with Anthony Janus in a biplane at a height of some 1,500 feet, Albert Berry climbed out of the seat and cut loose his parachute, which was suspended beneath the machine in a special case. He dropped suddenly for some 500 feet before the parachute opened, but it opened successfully and Berry reached the ground without hurt. Janus was able to control the machine when it was suddenly released of his companion's weight, and he, too, descended without mishap.

Over One Hundred and One Miles in an Hour on a French Monoplane.—Vedrine's latest record with his Deperdussin monoplane is 101 2/3 miles in one hour's time above the aerodrome at Pau. This new record was made on March 1st with a Gnome motor of 140 horse-power. The best previous record was 88 1/4 miles in an hour, made by the same pilot on January 13th, in a 100 horse-power machine of the same make. It is surprising that so small an increase of horse-power apparently should produce such a decided difference in speed. This only goes to show, however, that extremely high speeds can be obtained without excessive horse-power, provided the head resistance of the aeroplane is reduced as much as possible. In all probability at the International Cup Race in this country next summer a speed in the neighborhood of 150 miles an hour will be developed. France, Belgium, England, Switzerland and Holland will compete in this race, and each country will probably send three machines.

Aeronautics in France.—The latest figures with regard to aviation and aeronautics in France are \$4,800,000 for aeroplanes and \$1,600,000 for airships. Fifteen of the latter type will be constructed, and at the end of 1912 it is proposed to have 334 aeroplanes in operation. At the present time the French army has over two hundred. These aeroplanes, which are known as avions, are to be divided into flotillas of eight machines, six of which are to be always in full commission with two in reserve. These six machines are to consist of two monoplanes and four biplanes, divided into pairs and intended to carry one, two, and several men. The reserve machines are to be one monoplane and one biplane. The 208 avions now possessed by the army have been divided into thirteen flotillas, eight for field and five for garrison use. At the end of the year it is expected to have twenty-seven flotillas in the field and five for garrison work. A special flotilla of powerful high-speed machines will be attached to each of the field armies in time of war, for long distance reconnaissance work. Each flotilla is to have seven pilots, a quartermaster, four non-commissioned officers (including a chief engineer), and forty-four men.

A Record Flight from London to Paris.—On March 7th Henri Salmé, the chief pilot of the Biérol school at Hendon, England, left the aerodrome in his monoplane and flew to Paris without a stop—a distance of 237 miles—in 2 hours and 57 minutes. Because of a strong north wind, he was able to average over seventy-five miles an hour for the entire distance, which is about the same as from New York to Boston—a stretch that the ordinary expresses require six hours to traverse. The aviator traveled at a height of 6,000 feet—above the clouds—and steered by compass the entire distance. He alighted at the aerodrome at Issy-les-Moulineaux at 11 A. M., and shortly after 2 P. M. started on the return trip. In this he was not so fortunate, however, as against the strong head wind he made but slow progress. Overtaken by darkness, he was obliged to descend at Berck, 110 miles from Paris, after fighting the heavy wind for four hours. The next day he expected to continue back to Hendon. In his flight to Paris, he beat by 71 minutes the time of Prier, his predecessor at Hendon, who made the same flight last summer. In view of the coal strike in Great Britain making travel to Paris uncertain, Salmé tried the aeroplane as a means of transport, and found it extremely satisfactory.



Hauling crushed rock with a motor truck and at the same time pulling two trailers over dirt.



Motor truck with platform stakes for hauling lumber, pulling grader and drag.

Building Good Roads by Auto Power

A Cheap Way of Improving Highways

By Rex Beresford

THE monumental waste and inefficiency of the old time road district with its supervisor, and the "working out" of the road taxes in a sort of picnic, rather than in "fear and trembling" as salvation is said to be alone attained, has been largely abandoned. Efficiency marks the new plans. Men who know something about road building are being employed by townships and counties as road engineers or as "superintendents," where the term "engineer" rouses distrust in a farming populace. New machinery and new methods are being adopted at every turn. In fact, the 2,151,000 miles of roads and "near roads" that we have in rural United States are, as has been expressed by one person of unknown nationality, "now on the highway of improvement."

"The automobile," still quoting from the same gentleman, "has been a potent factor in this improvement, in both directions." It has proved a great stimulus for the good roads idea in the towns and cities, and among the farmers who own autos. On the other hand, it has created a good deal of opposition to the whole scheme of road improvement among farmers who do not own machines.

The introduction of automobiles has worked toward road improvement. There have been a good many cases where the automobile has been more than a moral agent in that direction. It has been hitched to a road drag and made to make smooth the rough places itself. To its credit be it said, that where the automobile has been put to such work it has done well and quickly what would otherwise have been left undone.

The split-log drag has been turned over to very good use by motor works located at Lansing, Mich. It occurred to the management that, while giving their cars the usual road tests, a double purpose could be served and the testing cars used to improve the conditions of the roads over which they passed. To this end, a split-log drag was contrived and attached to each car as it went forth to its test.

The experiment worked out admirably, as evidenced by the accompanying illustration, resulting in a vast improvement in the neighborhood and an economy to the borough. The work was accomplished without any expense of power or labor—simply by using the energy which formerly had been used exclusively for testing purposes.

It has been left to the big brother of the automobile, the motor truck, to turn seriously to the task of road building and road maintenance. So far the truck has been remarkably successful in road work. Especially is this true of the trucks fitted for traction work in pulling trailers, road graders, road drags, etc., as well as for hauling road and bridge construction materials on their own bodies.

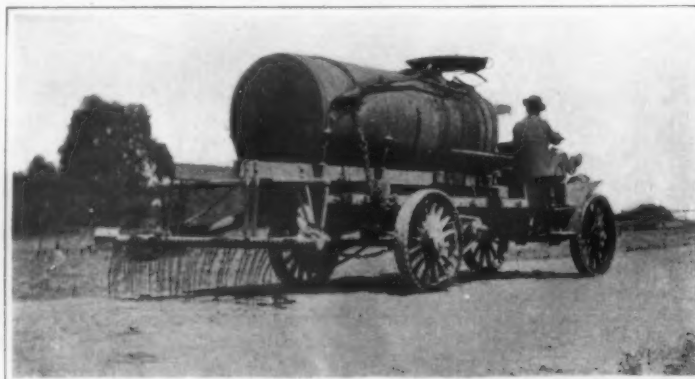
Since the "picnic system" of working roads has gone out of vogue it has been hard to find teams and drivers enough to do the work that was absolutely necessary



A five-ton motor truck used for road oiling near Worcester, Mass.



An automobile using the split-log drag to make good roads.



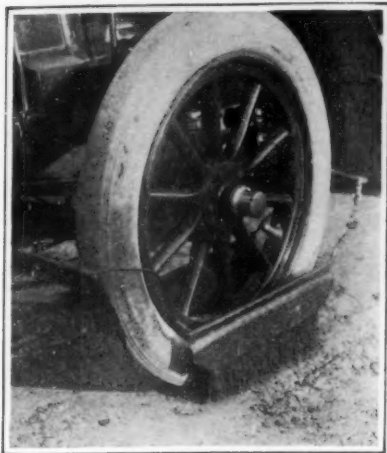
This truck hauls oil regularly every day. On Sundays it takes the ball team on trips to neighboring towns.

to keep the roads passable, without trying to start anything new in the way of road improvement. It takes eight horses and from two to four drivers, besides the man to operate the machine, to handle the ordinary blade grader such as is in common use all over the country where dirt roads are the rule (and that constitutes something over 2,000,000 miles of roads). It is next to impossible to hire a team without hiring a driver too, and a team and driver cost from \$2.50 to \$5.00 a day, depending somewhat on the locality and the demand for labor. At any rate, a grading outfit is operated by horse-power at an expense of from \$12.00 to \$16.00 or more per day, not counting the salary of the man who handles the grader.

Such an outfit does extremely well if it goes over a stretch of a mile and a half or two miles, cleans out the ditches, rakes the sod, trash, and a little bit of dirt into the middle of the road and deposits it there in bumps and hummocks much like those encountered in a Dakota slough, all in one day. In a good many instances it has been impossible to get teams and men when the roads were in fit condition to be worked. Seeding time, corn planting and plowing all come just about the time the roads need the most attention. The farmer in the corn belt, who will leave a corn field that needs him in order to work roads at ordinary wages, is an exception. Moreover, with such systems of working the roads, it has been found that it takes on an average, better than seventy-five per cent of the whole fund available to a community, just to keep the roads patched up and the ditches half cleaned out, leaving a scant twenty-five per cent to be spent in bridges, permanent roads and real road improvement.

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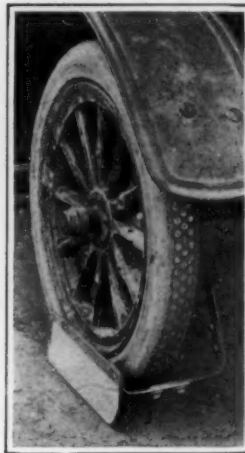
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The Pinaly guard.



The Morand guard.



The Roquejoffre guard.



The Van Durein device.

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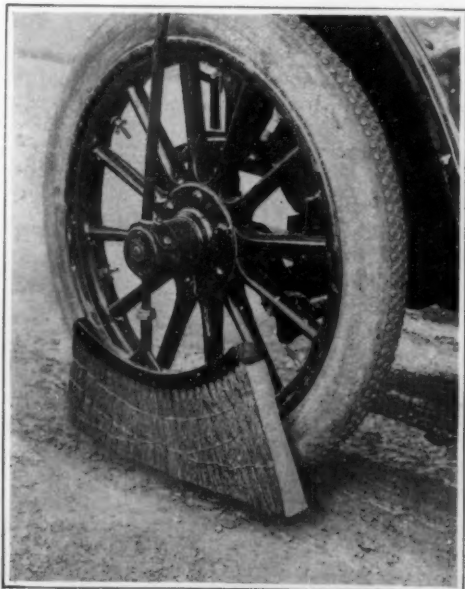
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Greeting With Tears

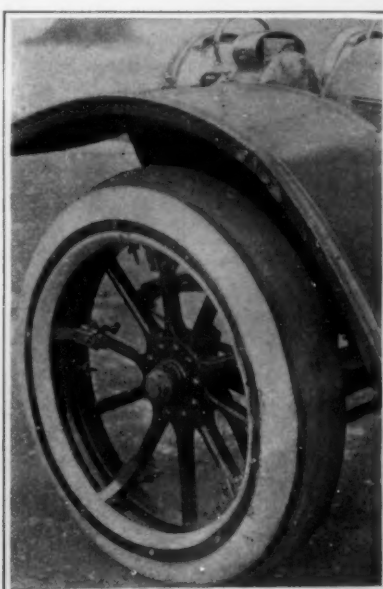
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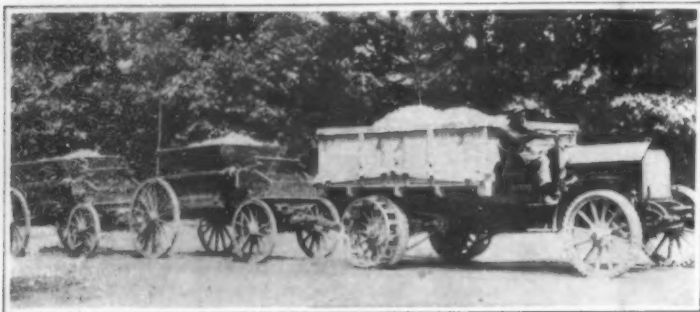


The Millard guard.



The Massenot guard.

FEARFUL AND WONDERFUL MUD-GUARDS TESTED IN PARIS



Hauling crushed rock with a motor truck and at the same time pulling two trailers over dirt.



Motor truck with platform stakes for hauling lumber, pulling grader and drag.

Building Good Roads by Auto Power

A Cheap Way of Improving Highways

By Rex Beresford

THE monumental waste and inefficiency of the old time road district with its supervisor, and the "working out" of the road taxes in a sort of picnic, rather than in "fear and trembling" as salvation is said to be alone attained, has been largely abandoned. Efficiency marks the new plans. Men who know something about road building are being employed by townships and counties as road engineers or as "superintendents," where the term "engineer" rouses distrust in a farming populace. New machinery and new methods are being adopted at every turn. In fact, the 2,151,000 miles of roads and "near roads" that we have in rural United States are, as has been expressed by one person of unknown nationality, "now on the highway of improvement."

"The automobile," still quoting from the same gentleman, "has been a potent factor in this improvement, in both directions." It has proved a great stimulus for the good roads idea in the towns and cities, and among the farmers who own autos. On the other hand, it has created a good deal of opposition to the whole scheme of road improvement among farmers who do not own machines.

The introduction of automobiles has worked toward road improvement. There have been a good many cases where the automobile has been more than a moral agent in that direction. It has been hitched to a road drag and made to make smooth the rough places itself. To its credit be it said, that where the automobile has been put to such work it has done well and quickly what would otherwise have been left undone.

The split-log drag has been turned over to very good use by motor works located at Lansing, Mich. It occurred to the management that, while giving their cars the usual road tests, a double purpose could be served and the testing cars used to improve the conditions of the roads over which they passed. To this end, a split-log drag was contrived and attached to each car as it went forth to its test.

The experiment worked out admirably, as evidenced by the accompanying illustration, resulting in a vast improvement in the neighborhood and an economy to the borough. The work was accomplished without any expense of power or labor—simply by using the energy which formerly had been used exclusively for testing purposes.

It has been left to the big brother of the automobile, the motor truck, to turn seriously to the task of road building and road maintenance. So far the truck has been remarkably successful in road work. Especially is this true of the trucks fitted for traction work in pulling trailers, road graders, road drags, etc., as well as for hauling road and bridge construction materials on their own bodies.

Since the "picnic system" of working roads has gone out of vogue it has been hard to find teams and drivers enough to do the work that was absolutely necessary



A five-ton motor truck used for road oiling near Worcester, Mass.



An automobile using the split-log drag to make good roads.



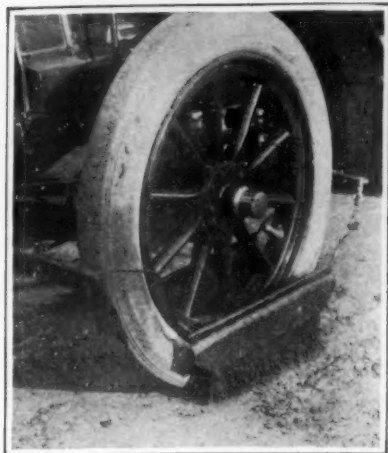
This truck hauls oil regularly every day. On Sundays it takes the ball team on trips to neighboring towns.

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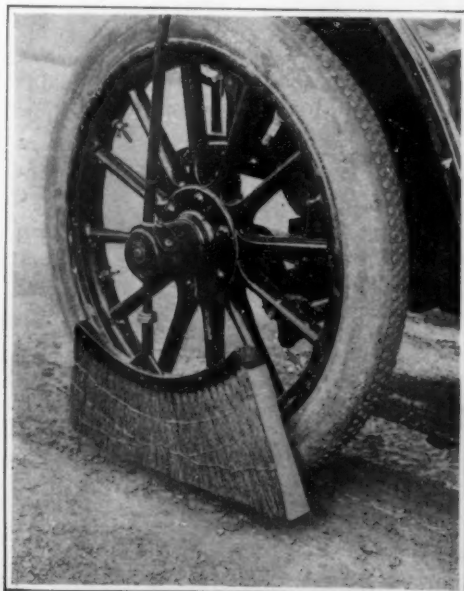
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Mixing the sand and clay on a sand-clay road in Florida.



Traction engine trains hauling broken stone.

Good Roads and How to Build Them

Federal Assistance in the Good Roads Movement

By Logan Waller Page, Director, Office of Public Roads

THE general introduction of the motor car on our public roads has ushered in a new epoch in the history of highway construction and maintenance. Old methods are giving way to new ones, not because they were unsatisfactory in the past, but because changed traffic conditions have rendered them unfit to satisfy modern requirements. Broadly speaking, the United States is in the midst of a national readjustment with regard to all matters pertaining to our highways.

But it must not be inferred that conditions are similar in all parts of the country. The questions which confront the road builders vary greatly with local conditions. Nor is there any one general solution which will satisfy the needs of all localities. Still there is no dearth of schemes, both new and old, which, like the once popular nostrums of the patent medicine men, are heralded to cure every ill that our roads are afflicted with. And all too often the road builder has listened to these glowing promises only to find after actual trial that his roads are as bad as before the treatment was begun. What we must first of all learn is that almost every community presents individual problems which must be solved with due regard to the local conditions involved.

The four most important considerations which confront the road builder to-day are: (1) how to more fully utilize the local materials, (2) to secure better and more definite information as to the character and behavior of some of the materials we are using, (3) systematic road maintenance, and (4) more business-like methods in road administration.

Recent investigations by the Office of Public Roads show that there are nearly 2,200,000 miles of public roads in continental United States. Of this vast mileage only 82/3 per cent were improved with a hard surface. This is only about one-third of the total mileage which should be improved in order to answer fairly well our present traffic requirements. Recent investigations as to traffic conditions on our country roads show that in general, in an area as large as a county, about 25 per cent of the roads carry 75 per cent or more of the traffic. In San Joaquin County, California, it was found that 20 per cent of the roads

carried 90 per cent of the traffic. In England the main roads comprise about 16 per cent of the total mileage, while the national State roads of France comprise only about 7 per cent of the total mileage. The need of properly locating our road improvements, so that they may be made to serve the real traffic requirements, is at once apparent. In many localities the real question is not how many miles of roads should be improved, but how to locate these roads so that a small mileage may be made to serve the needs of most of the people. Traffic data should be collected in every county where road improvements are contemplated, in order that these improvements may be properly planned and located.

The past year has been one of unusual activity in all lines of road work. All available data tend to show that about 11,000 miles of roads were improved with a hard surface during 1911. The total expenditure on our public roads during the year exceeded \$142,000,000. This expenditure is at the rate of \$64.63 per mile of road in the United States, or \$1.55 per inhabitant. The amount expended on the 11,000 miles of new construction was probably not less than \$40,000,000, while the remainder, or \$102,000,000, was expended for repair and maintenance. The above figures, while approximate, serve to call attention to the magnitude of our present-day road problems.

In order to reduce the cost of road building to a minimum and place good roads generally within the reach of every community, it is necessary that local materials be utilized to the fullest extent possible. Available materials, local conditions, road location, and character and density of traffic must all be carefully studied if we would avoid costly mistakes. Thus in large areas of the United States hard road materials are almost or wholly lacking, while the traffic is in general not very heavy. Here we find that by proper grading and drainage, together with systematic maintenance, our common earth or clay roads can be made to answer the present needs fairly well. Nor is there any loss through this method of procedure. The earth built up in this manner forms the very best foundation on which to place a hard surfacing later, when

means become available or the traffic becomes so heavy as to demand it. In the meantime we are learning the lesson of proper, systematic road maintenance, which at the present time is generally most sadly neglected on all of our roads.

In the southern and southwestern States especially, there are large sections where sand and clay are readily obtained. Clay and sand, when mixed in proper proportions, make a very good road surface for moderate traffic. The sand is very hard and admirably suited to resist abrasion, lacking only in adhesion or in binding power to form a firm road surface. The binding value is supplied by the clay. Only enough clay should be added to fill the voids, as its only purpose is to act as a binder. To secure the best results the sand should be sharp and fairly coarse, while the clay should possess a high binding value and be of fairly constant volume, that is, it should vary but little in volume with different amounts of moisture. Some of the so-called "ball-clays," or sticky clays, while very difficult to incorporate uniformly with the sand, when properly mixed with a suitable sand, form a very good road surface. The ball-clays give much better results than loam or slaking clays. Such a road surface seems to be affected but little by moderate automobile traffic. Surface treatments of different kinds of oils have been tried on the sand-clay roads; but, so far, these applications have been productive of but little good. The material seems to be too dense to permit even a quite liquid oil when applied hot to penetrate appreciably into the surface.

In the greater portion of the agricultural districts of the South, the cost of this form of construction is very low, ranging from about \$300 to \$600 per mile. This is no more than some of our States are finding that it costs annually to maintain the macadam roads subject to heavy automobile traffic. In the South the automobile traffic is as yet comparatively light, so that we have very little definite knowledge of how the sand-clay roads are going to behave under heavy auto traffic. All we can say is that so far, under moderate traffic, the results obtained from this class of construction are most gratifying. The advantages of the sand-clay



Bituminous macadam surface treatment in the State of Connecticut.



Bituminous macadam road in New Jersey—showing the mixing method.

road have proved so great in the South that it would be advisable for many other rural regions to consider the possibility of using this class of construction before adopting other and more expensive methods.

Gravel suitable for building country roads is found in many localities. Some of the chert gravels, especially those of Alabama and Tennessee, produce a road not inferior to the ordinary plain macadam. Many of the glacial gravels, such as those of Indiana, also make a satisfactory road for moderate traffic. The river or creek gravels, on the other hand, are usually too rounded and devoid of binding material to be suitable for road building, except for use in the foundation or in making concrete, etc. Gravel roads require considerable attention to maintain them in proper condition, and it is not probable that they will ever prove satisfactory under heavy automobile traffic. There are, however, many rural sections where the gravel road will answer the needs of the community and they should be adopted in preference to more expensive types.

The essential principle of the macadam road is the provision of an impervious wearing surface of broken stone, supported on a well drained foundation of the natural earth. Originally the rolling of the traffic was depended on to compact and solidify the loose stone on the road, but now a self-propelled roller, weighing from ten to fifteen tons, is found to be more economical and satisfactory. Before any stone is placed, the earth foundation is thoroughly consolidated by means of the heavy roller. On this prepared foundation the broken stone is placed and rolled in three courses. The first course consists of stones, varying from $1\frac{1}{4}$ to 3 inches in their largest dimensions. The second course is composed of stones of from $\frac{1}{2}$ to $1\frac{1}{4}$ inches, while the top or binder course consists of sizes varying from dust to $\frac{1}{2}$ inch in size. The purpose of this layer is not to give a wearing surface, but to firmly bond the stone already placed. After the top course of screenings is spread on the road, it is sprinkled and rolled until the surface is thoroughly compacted and firmly bonded, when the road is thrown open to traffic.

Many would have us believe that the days of the plain macadam roads are past. But it should be kept in mind that, where the old traffic conditions prevail, the plain macadam is as useful and valuable as ever.

Until very recently water-bound macadam was considered as the ideal construction for country roads. The methods of construction had become very well standardized and the probable life of such a road could be fairly well predicted as well as the annual maintenance charges. Then, all at once, all our previous

calculations were upset by the coming of the automobile. Under the changed conditions, past experience and accumulated data were of little value, and, however reluctantly, we were soon forced to admit that a water-bound macadam road that would stand heavy, fast, automobile traffic could not be built. It became evident that, if we were to prevent the total loss in many sections of the macadam roads already built, a more powerful binder than the stone dust must be



Building a macadam road by the standard methods.

found and that new methods of maintenance must be developed at once. The old method of sprinkling with water has proven not only ineffectual, but prohibitive in cost.

As soon as this new problem presented itself, scores of remedies were offered as sure and permanent cures for the difficulties. It is hardly necessary to add that many of these have been tried only to be found wanting. Gradually the worthless methods and materials have been weeded out and the behavior of others more definitely determined, though our knowledge in this direction is still far from perfect. The question is gradually narrowing down to one of local availability and adaptability to local conditions at a reasonable cost. By reasonable cost is meant not so much first cost of materials or application, as the sum total cost of maintaining the road in proper condition for a term of years. It is only by expressing the cost in this way that we can judge fairly between the relative efficiency of different methods and materials.

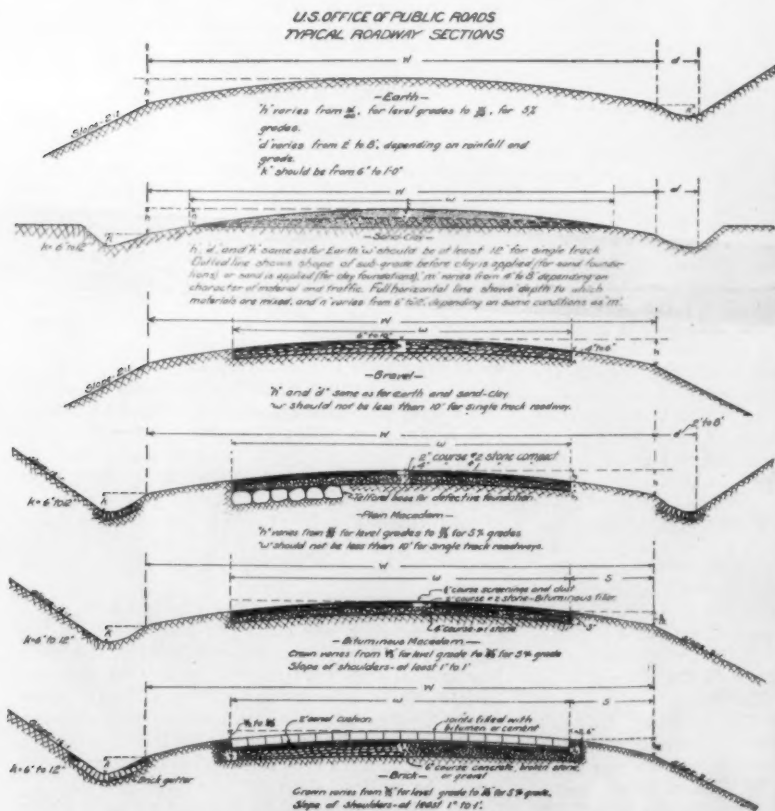
At the present time, wherever plain macadam construction is used on main line or trunk highways sub-

ject to heavy automobile traffic, recourse is usually had to some form of surface application in order to alleviate the dust nuisance and preserve the road. The materials used for these surface applications have gradually narrowed down to some form of tar, asphaltic oil or deliquescent salt. The more permanent dust-laying and road-preserving qualities of the tars and oils used depend upon the character and percentage of binder base which they contain. The salts on the other

hand depend on their hygroscopic qualities to collect and retain at or near the road surface sufficient capillary water to hold the particles in place largely through surface tension. The moisture also assists the natural processes of cementation which form a large part of the bond in a macadam road surface.

Surface applications of native or artificial bitumens of varying consistencies have been very popular for several years. The general opinion has been that the asphaltic base would gradually accumulate from each application and the road surface would thus be strengthened from year to year. For a time this has worked well and, where care and skill have been exercised, a gradual upbuilding of the road surface has resulted, especially where considerable quantities of stone screenings or chips were added after each application of the binder. But present indications are that this upbuilding process is not always permanent. In many cases, the binder seems to lose its life or binding power after the lapse of a few years, and the entire surface which has been so slowly and laboriously built up crumbles and goes to pieces. Just what is the cause of this seemingly rapid deterioration after a number of years and how many of the binders are thus affected is as yet unknown. But the failures which have been recorded up to the present time are sufficient to create considerable anxiety among road builders. Much additional investigation, research and experimental work is needed to determine the extent and exact cause of these failures as well as how to prevent their occurrence in the future.

In the construction of bituminous macadam roads two general methods are very largely used: the penetration method and the mixing method. In the penetration method the process of construction is exactly similar to plain macadam, until the second course of stone has been placed and rolled. The bitumen, usually heated in order to increase its fluidity, is then sprinkled or poured over the stone. Screenings or stone chips are added and rolled with a heavy roller, until the stone chips are largely forced into the voids in the second course of stone and a compact impervious surface is formed. Another coating of bitumen is usually flushed



Typical road sections recommended by the U. S. Office of Public Roads.



Constructing a road of chert gravel, which gives a road comparable with macadam.



Building an earth road in Texas. Note inclination of wheels to prevent side-slip.

over the surface in order to insure that it is completely impervious. Enough sand or screenings are usually added to the surface to take up any excess bitumen.

Largely because of its higher first cost, due to the additional amount of labor required, the mixing method is not used so generally in this country. The stone for the second course is mixed with the bitumen before placing it on the road. So long as each stone is uniformly coated with the bitumen, the mixing may be done either by hand or by machine. The advocates of this method claim that a stronger and more uniformly bonded road surface is secured than can be gotten by the penetration method. Both of these methods seem able to withstand quite heavy automobile traffic. But where a heavy mixed traffic is encountered, neither

method can be said to be anything like ideal.

Brick roads are coming into favor in many sections where a good paving brick can be produced at a low cost. A good paving brick or block, when laid on an unyielding foundation, is able to resist very heavy mixed traffic without serious injury. In such sections as Ohio and Pennsylvania, brick should find considerable use as a local material, especially in the construction of trunk line roads engaged in carrying heavy mixed traffic.

From the above it can readily be seen how largely the solution of road problems confronting any community depends on local conditions. What is a solution in one place may be a mistake in another, and what is advisable in one locality it may be folly to use in another. The Government, in recognition of

the diversity of the road problems and the need of skilled assistance in their solution, has established the Office of Public Roads in the Department of Agriculture. Aside from roads constructed in island possessions and in National parks, the Government makes no direct appropriation for road building, except a small annual appropriation for experimental work. Through the investigations and researches carried on by the Office of Public Roads and its corps of trained experts and engineers, it has done much to reduce the cost of road improvements and to prevent loss through the use of improper methods and unsuitable materials. The Government does not in any way compete with individuals or companies, but takes up those lines which would otherwise remain undone and thus cause great loss to the country at large.

The Scientific Aspects of Bell-Making

A Foundryman Who Must be a Metallurgist as well as a Musician

By H. J. Shephstone

THE art of bell-making is one of the most ancient and one of the most modern in the world. From the first dawn of civilization men have evoked sounds from crude instruments that in principle, if not in shape, bore some resemblance to a bell. To-day the best brains are being picked everywhere to produce bells that are at once durable, artistic, and melodious. Bells are made in a score of forms and sizes, and they are turned to a thousand uses. Many of the most thrilling events in history have sprung from the vibrations of a bell. All through the centuries the pealing of a "Great Tom," or a "Santa Maria," has called men to prayer, summoned them to battle, and warned them of the approach of storm and flood and fire. As early as the year 680, church bells were imported into England from Italy. Now the process is reversed. Bells are manufactured in England and exported to the ends of the earth.

Indeed, the oldest industries in Great Britain to-day are the bell-foundries. There is one in Whitechapel, in London, that was founded 350 years ago and it is by no means the oldest. There are many whose existence can be traced back for a couple of centuries and more. Our photographs, however, depict the methods of bell-making as carried out in one of the more recent establishments, namely, that of Gillett and Johnson, of Croydon, England, where bells have been turned out for over half a century in large quantities for all parts of the world. The firm is famous for the many big bells it has cast and for their beautiful tone.

The metal from which the bell of to-day is made is usually composed of sixteen parts of copper to five of tin. But this standard is not uniform, and it is liable to modifications. Sometimes when a founder in olden days had cast a bell away from his manufactory, he was driven by time or circumstances, to put in too much or too little of one of the ingredients. The result was always more or less unsatisfactory. Then again, tin melts at 440 degrees, and it requires 1,995 degrees for the same operation in copper. Thus the former metal, to some extent, evaporates in the furnace, and has to be replenished a little. In the case of hand-bells, the proportion of copper is increased. This is because the sides, being thin, the normal ratio of tin would render them liable to crack. Old copper makes the best metal and most of the tin used by the larger bell-founders comes from Australia.

The first step, of course, is the building of the mold. Indeed, it is the most vital stage in the evolution of a bell. A blunder here might mean so dismal a failure that the ordeal of casting would have to be repeated, or even an explosion, in which men and buildings might be blown to fragments. At the bottom of the deep pit under the mouth of the furnace, the workmen, with a pile of bricks, build up a structure called the "core." This forms the shape and dimensions of the inner side of the bell. The core is then coated with loam, smoothed with a delicately adjusted crook, or template, worked on a pivot, and then thoroughly dried. An iron hood is requisitioned to form the outer side of the future "Great Peter" or "Ave Maria." The inner part of the case is spread with loam and carefully smoothed and molded by the crook. The hood is then hoisted over the core, and adjusted to it with the utmost exactness. The distance between them represents the space to be filled by the metal when it rushes from the furnace. It is obvious that if the two sections of the mold do not precisely correspond with each other, the bell cannot be uniform in its shape and its thickness. Carefully smoothed channels lead from the orifice of the furnace to the top of the pit. The flow of metal can easily be regulated into the mold or diverted from it.

When the bell is cast and trimmed it is transferred

to the tuning-shop, where by means of modern machines, specially designed for the purpose, metal is pared off from the inside of the bell according to the need. Perhaps the greatest revolution in the bell world of modern times has been with regard to the tuning. Canon Simpson, an English clergyman, was the first man to point out to the musical public that bells were rarely, if ever, in tune, but that this state of things could be remedied if certain facts were borne in mind.

Briefly, the facts are these: That a bell, to be properly in tune with others, must first be properly in tune with itself, namely, it must have at least five tones at correct intervals to one another, so as to form a perfect musical chord. These tones or harmonics, as they are called, are the hum-note, fundamental, and nominal, also the third and fifth to the fundamental (or strike note). Putting the first three named in musical notation, with a C bell for example, we get—



thus producing three C's in octave.

Small bells, curiously enough, were always the bell-founders' trial, and the smaller they were, the worse were their tone and tune; but with the complete mastery of the harmonics all these difficulties passed away, and no matter how small the dimensions, bells can be made to sound as pure and sweet in tone and accurate in tune as any other musical instrument. Naturally, the casting of these hand-bells is child's play compared to fashioning a giant of half a ton in weight. With their modern appliances it is easy for the workmen to bale out the hot metal and pour it into the little molds.

Then the production of the accessories is a very important branch of the work of a modern bell-foundry. When it is remembered that ringers are sometimes fondling their ropes for more than four hours at a time, it is clear how necessary it is that a peal should swing smoothly and accurately. The sockets in which the bars that support the bell are inserted are made of gun-metal, and are as smooth as glass. Formerly the beams of a belfry were invariably of oak or other wood. Now timber is yielding to metal. Out of eight frames that were in the course of construction in the foundry under notice only one set was made of oak. All the others were fashioned in iron. The wheels, which swing to and fro as the ropes are pulled, are oaken, and display the most skillful workmanship. The ropes are all stretched across a beam, with a heavy weight at each end of them, until by the strain they become as hard and as supple as strips of steel.

Eight bells generally form a peal in a church tower. The first peal of bells to be erected, namely, a collection of bells tuned in harmony together, was that built in Crayland Abbey, in Lincolnshire, in 870. It was in the seventeenth century that real "change" ringing came into vogue and became exceedingly popular. To-day it has certainly reached a very high state of perfection. It may be of interest here to note that whereas a peal of five bells will allow but 720 changes, from a peal of twelve bells 479,001,600 changes can be rung! The heaviest ringing peal of bells in the world is that in the South Tower of Exeter Cathedral. There are ten bells in the peal, the smallest having a diameter of

2 feet 8½ inches, and a weight of 806 pounds, the largest boasting of a diameter of 6 feet and a weight of 8,112 pounds, or 3.6 English tons. Then there is probably no other article as good as new after half a century of wear as a church bell, for even if it becomes cracked it is still worth two-thirds of its original value.

Work of the Bureau of Printing and Engraving

PROBABLY few of the users of postage stamps and spenders of greenbacks realize that these two articles are the product of one of the biggest factories belonging to a national government: viz., the United States Bureau of Printing and Engraving, at Washington. The report of Director Ralph for the fiscal year 1911, just published, contains some impressive facts and figures.

The amazing number of *ten billion* postage stamps were printed here last year—to be exact, 9,773,424,200. The output of notes, certificates and bonds was about 67,000,000 sheets; of national bank notes, 12,000,000 sheets; of internal revenue stamps, 84,000,000 sheets; of customs stamps, 153,000 sheets; of checks, drafts and miscellaneous, 2,265,581 sheets. In all, 262,806,113 sheets of the various government issues were printed.

The enormous output of paper money is explained by the fact that its average life is only between two and three years. Americans are averse to the use of coin. Thus nearly the whole of our gold coinage goes into the Treasury, where it lies inert, while the paper money issued against it circulates. The Treasury now holds more than \$1,200,000,000 in gold—such an accumulation, it is said, as has never before been known.

Cipher Wireless Telegraphy

THE use of secret writing in wireless telegraphy is bound to prove especially advantageous as according to the present state of affairs everybody acquainted with the Morse alphabet is able to intercept any wireless telegram at short distance even with the ear, unassisted by any receiving apparatus.

If the order of letters in the alphabet be changed in any way, placing the alphabet in its right order above this row of letters and replacing each letter of a document by the corresponding letter of the permuted alphabet, a ciphered document, viz., a document in secret writing will be obtained. Now it is a well-known fact that none of the secret alphabets so far suggested was able to resist the art of deciphering. As in fact each letter occurs with a given frequency in each language (the German e for instance 90 times, the n 60 times, the s 50 times, the t 40 times in a total of 600 letters), it is merely required to figure the numbers of equal letters in order at once to know which are the letters e, n, s, t, etc. Any less frequent letters are simply guessed, after ascertaining the identity of the rest.

Prof. Zehnder's secret writing readily adapts itself to the typewriter, any chance of deciphering (in the absence of a key) being removed by using for each line or even each word another permuted alphabet. In this case any attempt at deciphering by calculation will be hopeless indeed as each letter occurs with about equal frequency. A typewriter allowing the alphabet to be exchanged for each line or even each word could readily be constructed on the type-roller system.

This scheme suggested by Zehnder as far back as thirty years ago for the secret political correspondence of Abyssinia had never been made public until its present contemplated application to wireless telegraphy.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Speed Alarm for Taxicabs

To the Editor of the SCIENTIFIC AMERICAN:

I have understood that on taxicabs in London an appliance has been used by which an automatic alarm is sounded when a given speed has been attained. It has always seemed to me that we need something of this kind as a protection from the dangers of over-speeding. It would notify both the chauffeur and the public, and it seems to me, save many lives and much suffering. Has anything been done in this direction, in this country?

Lynn, Mass.

READER.

Our Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

I am glad to see that you continue to publish in your correspondence columns communications in regard to the revival of the merchant marine, for "opinion in good men is knowledge in the making," according to John Milton.

Your excellent and timely editorial on the importance of our South American trade and the construction of vessels specially adapted to meet commercial conditions in our relation with the great continent southeast of us was read with much pleasure. Give your readers more of the same kind, on the same subject.

Canton, Miss.

JAMES G. MCBRIDE.

How to Cure Gyroscopic Effects of Aeroplane Propellers and Motors

To the Editor of the SCIENTIFIC AMERICAN:

Gyroscopic force can exert a temporary but cannot exert a constant tendency to turn an aeroplane to right or left. The constant tendency must have a different cause. The revolving propeller presses downward on one side and upward on the other side. This must be balanced by one wing having a greater angle of incidence than the other. This causes the constant tendency because the thrust is in the center. Two propellers revolving oppositely would cure this fault, and two engines revolving oppositely at equal speed would cure gyroscopic error.

Meriden, Conn.

J. FRANK GELLETLY.

A National Peril

To the Editor of the SCIENTIFIC AMERICAN:

It is gratifying to note from the editorial in your issue of the 10th instant, "A National Peril" that your excellent journal keeps upon the alert in pointing out the dangers ahead.

Congress should not only respond favorably to the call from the Secretary of the Navy in regard to additional battleships, but should enact before the close of the present session a mail subsidy or an ocean mail bill for the upbuilding of a merchant marine to serve as an auxiliary navy.

Battleships alone will not complete our preparedness for war. Large fleets of merchant vessels, in deep-sea commerce, so constructed that upon short notice they could be converted into warships, transports, supply ships, colliers, hospital ships and all other requisites of the navy, to be placed immediately at the disposal of the Government in the event of war, would be almost as essential as the battleships.

National economists might also reflect that merchant ships would not only assist as a guarantee of peace, but would save America \$300,000,000 annually now paid in freight charges to foreign steamship lines.

Canton, Miss.

JAMES G. MCBRIDE.

When Like Poles Attract Each Other

To the Editor of the SCIENTIFIC AMERICAN:

Practically all text-books on physics contain the following law of magnetism: like poles repel each other and unlike poles attract each other. Some recent experiments in our laboratory lead me to believe, if I have not misinterpreted the phenomena, that this statement needs some qualification. Electro-magnets were used in these investigations in order to avoid the frequent changes of polarity which permanent magnets undergo when subjected to the stresses of experimentation. However, the same phenomena were observed when permanent magnets were used.

It was found, for example, when two similar poles of unequal strength were made to gradually approach each other, that repulsion ensued until the poles came within a certain distance (dependent upon conditions) when attraction took place. The more nearly equal the polar intensities, the less the apparent attraction be-

came, although it was noticeable in every instance under our observation. Hence it would appear in the reaction of like pole upon like, that there are two zones, one of attraction very close to the poles themselves, and one of repulsion beyond the former.

These zones may be made evident to the sense of touch by the use of a magnetic "wand," a long electro-magnet of small diameter and equipped with flexible connections, so that it may be held in the hand and moved through different parts of a given magnetic field. Any experimenter who uses such a piece of apparatus will be struck by the similarity of magnetic and pressure phenomena. Old as is the subject of magnetism, it certainly affords a most fruitful field for research.

CLAUDE C. KIPLINGER.

Lincoln (Ill.) High School Laboratories.

The Principles of Water Power Development

To the Editor of the SCIENTIFIC AMERICAN:

As I see considerable space in your SUPPLEMENT occupied with Dr. McGee's discussion of the Principles of Water Power Development, I wish to offer a few comments from a western point of view.

Your eastern readers probably suppose from the tenor of the article mentioned that water in the West is still awaiting the vivifying effect of federal legislation. No more grotesque error could be imagined. The western States all provide by ample laws the mode of acquiring both irrigating water and water power; development has been proceeding normally and satisfactorily until quite recently when under the influence of the muck-rakers the government was induced to take steps toward the assertion of a right, unsuspected until now, of regulating the use of water for power on public lands. The withdrawal, or attempted withdrawal, of the right to use water on public lands has gone just far enough to confuse the situation and keep capital from water power development in new projects, but no federal legislation has been enacted to show what the ultimate position of the government will be; in fact, it may be confidently asserted that legislation such as would admit the federal government to partnership with the State in control of water cannot possibly be carried through Congress. It would be impracticable, undesirable, unconstitutional, and contrary to the whole policy by which the water question is already pretty well settled in the West. Hence the question of main interest in the West is how long the government will hold up development.

Dr. McGee gropes in the "twilight zone," endeavoring to gather together enough cases to strengthen the policy of federal partnership, but ignoring the broad and obvious fact that water has been controlled by the States from the beginning of our history, and that few if any serious objections to that policy have developed. It is natural to absorb, in the city of Washington, the doctrine that the federal government can do things better than any other agency; but a brief residence in the West is sufficient to show the fallacy of the theory as applied to water.

Fundamental guarantees of the rights of future generations in water and power are two: forfeiture for non-use and permanent right of regulation of charges by the State. Both of these are embodied in the constitution of Idaho, and the other western States have similar provisions. All that the situation requires is that the federal government recede from its position. This will enable us to proceed with development.

Moscow, Idaho.

J. M. ALDRICH.

Gyroscopic Action in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN, open forum, page 129, issue of February 10th, you publish an article Re. Aeroplane Steering, by one S. S. Jerwan, who, as a licensed aviator of the Aero Club of America, attempts to set your readers right on the scientific *raison d'être* of the gyroscopic forces obtaining in aeroplanes and how they influence steering. He tells that when a propeller turns "from left to right" the aeroplane, through reaction, "turns left, or in the opposite direction of the revolving propeller." As a corollary of this, he tells how when steering left, the aeroplane dips, and when steering right the aeroplane rises, etc. This, while the propeller turns from left to right!

The volume entitled "Vehicles of the Air," by Victor Longheed, is to-day regarded as authority on all points relating to aeroplane construction and operation. On the subject of propulsion and gyroscopic action as affecting steering, Longheed says and illustrates how (page 263) gyroscopic action deviates a machine from a desired course. Using his words, "This deviation is always in the direction of the rotation. Thus, with a propeller rotating clockwise, as viewed from the rear of the machine (Jerwan's 'left to right' citation) in steering to the right the prow drops, and in steering to the left the prow rises. In steering up the prow draws to the right, while in steering down the prow goes to the left."

Here we find a direct contradiction as between Messrs. Longheed and Jerwan. In justice to both these gentlemen, and considering the hundreds of aeroplanes under construction whose builders might be led—or misled—into serious consequences by applying control levers in accordance with one of the views in question, I am prompted to suggest that you set the matter right, at the earliest possible moment.

Retractions come hard, but no man is "licensed" to publish *didactic* matter so couched as to be subject to misinterpretation. It is a species of sowing that reaps a harvest—already overfull.

Los Angeles, Cal.

JOSEPH A. BLONDIN.

The Olympic-Hawke Collision

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest your various articles on the collision between the "Olympic" and the "Hawke," and must confess myself surprised that the matter is so little understood.

I may be in the wrong, but it seems very simple to me.

When one ship is passing another, especially if the faster ship is the larger of the two, the water which naturally conforms to the form of the ship, begins at about the center of the ship to flow in toward the ship to replace that which has been displaced by the passage of the ship. This inflow would naturally catch the slower ship on the opposite bow side, and when the slower ship was once diverted the least bit from its course would have a powerful effect in drawing it toward the faster ship.

If one will watch the particles in water as it appears to rush past a rapidly moving ship, they will easily get an idea of the force with which this suction would act on the slower ship.

When a ship is passing through the water under normal conditions, the resistance at the bows is nearly equal, but the suction of the water toward the larger and faster ship will practically remove all resistance from the side of the slower ship which is next to the other. This sudden change in conditions to my mind easily accounts for such collisions as the "Olympic" and the "Hawke."

I hope I have made the point clear without being tiresome.

T. D. LONG.

Manson, Iowa.

Are We Backward in Invention?

To the Editor of the SCIENTIFIC AMERICAN:

I read an article in your journal quoted from *Engineering News* entitled, "Why is America Behind Europe in Pioneer Inventions?"

The article in question is a string of generalities with little or no attempt to quote specific cases.

It might be well in this connection to cite the inventions that have benefited the human race at large and the country of their inception. At the time the steam engine was invented this country was a mass of political agitation and, aside from Franklin, had no inventors. However, Franklin found time to demonstrate the identity of lightning and to invent the lightning rod, and what was of more importance he made the first stove.

Then we can pass to Fulton's work, the steamboat, lead pencil and torpedo, and from that to the cotton gin and the sewing machine. The telegraph, submarine cable and the telephone made all distances one. Vulcanized rubber, the modern cylinder printing press, all the agricultural machinery that has made the cultivation of our vast prairies possible, practically all the woodworking machinery, and at least nine-tenths of the labor and time-saving devices of the world to-day had their birth in this country.

But the list is not complete—

The revolving turret and submarine boat, although the latter was an old dream with many inventors. This is equally true of many other inventions. Still following up the art of war we have the revolver and repeating rifle and gatling gun.

Going back to more important subjects we have the electric light and transformer, the typewriter, the air-brake, and last the flying machine. The railroads have the Pullman cars and automatic couplers and other devices that make fast, heavy trains possible.

On the other hand, in the same time, Europe has produced the locomotive, the gas engine, photography, and wireless telegraphy. In chemistry Europe has the lead, but in machinery and mechanical devices generally this country leads now and always has, especially when we take into consideration efficiency and convenience, and you can to-day tell any American machine or tool at a glance.

I have trusted to my memory in making up this list and would like to see a complete list of inventions and processes of your compilation, as you have better facilities for doing this.

L. N. W. SMITH.

Omaha, Neb.

What the States of the Union Are Doing for Good Roads

Bills Before Legislatures; Present Conditions All Over the Country

[Many weeks ago the Editor of the SCIENTIFIC AMERICAN sent to the State engineers, highway officials, and secretaries of State of every State in the Union a letter in which he asked what the various States were doing to improve their roads. In the following summary will be found a compilation of the answers received. It is a regrettable discovery that, despite the campaign which has been waged for better roads since the automobile first appeared, most of our States still display only a lukewarm interest in a matter of vital importance to them. Wherever it has been impossible to obtain information from State authorities, the bulletins of the Office of Public Roads have been freely drawn upon.—Editor.]

ALABAMA.—A State Highway Department was created in April, 1911. Bulletins have been published giving the State highway laws and discussing the roads and road materials of Alabama. The State feels the need of competent highway engineers. "It is evident," says Dr. W. F. Prouty, "that such engineers would save thousands of dollars to the taxpayers, and at the same time would give us far better roads." The creation of the State Highway Commission marks a new era in the progress of Alabama. From now on economical methods of road construction and maintenance will be much more rapidly adopted. Alabama has about 50,000 miles of public roads. In 31 counties there are no improved roads; in 17 counties less than 10 per cent are improved; in 11 counties from 10 per cent to 19 per cent are improved; in 4 counties from 20 per cent to 29 per cent are improved, and in 4 counties 30 per cent are improved.

ARIZONA.—The State Engineer informs us that the Legislature will not convene until some time during the month of March. While it is probable that a highway bill will be passed at that time, it is impossible to state just what provisions will be made for good roads. Arizona has about 6,000 miles of public roads. No marked improvement has been made in the last ten years. About 5 per cent of the roads in the State are improved.

ARKANSAS.—A State Aid Bill, drafted by W. A. Falconer, president of the Arkansas Good Roads Association, will be reintroduced at the legislative session which convenes in 1913. If it is passed Arkansas will have a State Board of Road and Highway Commissioners. At present the Commissioner of Mines, Manufactures and Agriculture is intrusted with the improvement of Arkansas roads. The State has about 37,000 miles of public roads.

CALIFORNIA.—No information could be obtained from the State authorities. According to a bulletin of the Office of Public Roads of the United States Department of Agriculture, prepared by J. E. Pennybacker, Jr., and Maurice O. Eldridge, California had at the close of 1909, 46,069 miles of public roads. The oiling of roads has been abandoned to a large extent. While there were 2,145 miles of earth roads reported as having been oiled in 1904, there were only 653 miles of oil roads reported in 1909. The types of improved roads ordinarily built in California are sand-clay, gravel, macadam, and bituminous macadam.

COLORADO.—Colorado has a State Highway Commission operating under an act which went into effect May 5th, 1909. The commission began by asking the authorities of fifty-nine counties, commercial clubs and similar organizations to co-operate in a movement to improve the State roads. The result of this campaign was fairly satisfactory. Interest was aroused. The State Highway Commission is hampered because it is not placed on a financial basis equal to its undertaking. The present highway law was amended by House Bill No. 200. The legality of that law has been attacked and a decision will be handed down some time during the coming spring by the State Supreme Court. Colorado has about 30,000 miles of public road. Owing to the light traffic and dry climate, the natural earth roads, if placed on proper grades and provided with suitable culverts and bridges, are satisfactory for all ordinary purposes.

CONNECTICUT.—There will be no session of the General Assembly until next year. The Legislature meets biennially, unless convened in special session by the Governor. The Highway Commissioner of Connecticut has \$3,000,000 available for work in 1912. The State has about 13,000 miles of public roads.

DELAWARE.—The most noteworthy effort to improve the roads of Delaware is that of Mr. Coleman duPont. An article in this issue of the SCIENTIFIC AMERICAN describes his work. Delaware has about 3,000 miles of public roads, surfaced with stone, with gravel, with sand-clay and with shells.

FLORIDA.—Florida has no good roads department. All roads and highways in the State are constructed by the counties under the supervision of the county commissioners. The result is that there is no concerted movement for the improvement of roads in general. Florida has about 18,000 miles of public roads.

GEORGIA.—No information could be obtained from the State authorities. From Bulletin 41 of the Office of Public Roads, United States Department of Agriculture, we learn that there are less than 83,000 miles of public roads in the State. Between the years 1904 and 1909 Georgia increased her mileage of improved roads by 275 per cent. In 54 counties there are no improved roads. In 52 counties there are less than 10 per cent improved roads. In 21 counties there are from 10 per cent to 19 per cent improved roads. In 8 counties from 20 per cent to 29 per cent of the roads are improved. Eleven counties 30 per cent of the roads are more than improved.

IDAHO.—No information could be obtained from the State authorities. From Bulletin 41 of the Office of Public Roads of the United States Department of Agriculture, we learn that there are about 18,500 miles of improved roads.

ILLINOIS.—Illinois has about 94,200 miles of public roads, of which about 9,000 are improved. No satisfactory information can be obtained from the State authorities.

INDIANA.—There is no concerted movement for good roads in Indiana. From the public roads amounts to 68,000. Indiana has a fairly large mileage of good roads, because farmers are permitted to work out their taxes by hauling gravel on the roads. Work of this kind is not always satisfactory. The gravel is left in heaps and often entirely disappears into the mud before the winter is passed. Good road building gravel is available in almost every county.

IOWA.—There is no Legislative Assembly this year. Last year a drag law was passed, a measure providing county engineers, and an automobile law. The total mileage of roads is 102,500. About 2,500 are improved. About 30 counties in the State have no improved roads, while the rest have less than 10 per cent improved roads to show. The split-log drag is used considerably.

KANSAS.—Kansas has about 98,300 miles of laid out public highways. Last year approximately \$3,000,000 were expended for roads and bridges, and this year about \$3,500,000 will be available. Ideal earth roads can be constructed and maintained at little cost in the western two-thirds of the State. In the eastern third of the State the annual rain fall of 35 inches and a heavy soil complicate the road problem. Good roads is the most talked of public question in the State. Two years ago a highway was established across the State from Kansas City to the Colorado line, known as "The New Santa Fe Trail." During the past year a north and south highway known as the Meridian Road was established across the State from north to south. It follows closely the sixth principal meridian, and was the first link in the Winnipeg-Gulf Highway. Two other cross-State highways have

been established recently. The State Constitution prohibits internal improvement work, so that until it is changed no State aid can be granted. The new road law requires that both the property and poll taxes be paid in cash, and that the roads be classified according to their relative importance and utility as State roads, county roads, mail routes and township roads. The State roads and county roads are constructed and maintained at general county expense, and the mail routes and township roads are constructed and maintained at township expense. The provision for State and county roads makes it possible to establish a comprehensive system of good practical highways throughout every section of the State, and gives an equitable distribution of the cost. The office of State Engineer was established two and a half years ago at the Agricultural College, and plans and specifications for road and bridge work and drainage and irrigation projects are furnished free of charge. The office has furnished speakers for about four hundred public meetings, and plans and specifications and estimates for 300 bridges and about 700 miles of road.

KENTUCKY.—There are 53,800 miles of public roads in the State. About 19 per cent of the roads in the State are improved. In 46 counties, however, there are no improved roads. These counties are located principally in the eastern and southwestern part of the State. No information could be obtained from the State authorities on the good roads situation.

LOUISIANA.—It is intended to submit to the Legislature at its session next May a bill to provide for levying a State license on motor vehicles and also a license for chauffeurs. The New York State law on motor vehicles will probably be used as a basis for this bill. There are 25,000 miles of public roads in the State.

MAINE.—There are no bills on good roads before the special session of the Legislature. Under the State Aid Law now in existence in Maine the appropriation for continuous good roads has been split up and scattered all over the State, because under the law a certain portion of the State money must be joined with money raised by the local community. Hence, there are pieces of good road varying in length from 1 to 5 miles scattered over the State, with stretches of bad road between. The income from an automobile tax during 1912 was about \$120,000. Mr. Lyman H. Nelson has started a movement to capitalize this tax; in other words to borrow \$2,000,000 to build good roads with the money raised. The total mileage of public roads is less than 26,000.

MARYLAND.—The total mileage of public roads is 16,800. About 2,200 miles are improved. No accurate information can be obtained from the State authorities.

MASSACHUSETTS.—There are now fifteen bills relating to highways before the Massachusetts Legislature. The Massachusetts Highway Commission has suggested legislation for preventing and repairing damage to highways; recommended that an act be passed in 1912 appropriating the sum of \$5,000,000 for the reconstruction of highways for the five years beginning with the year 1913. Automobiles are paying a large sum into the State Treasury, nearly \$400,000 a year being collected for the maintenance of highways and for the construction and repair of through roads in the smaller towns. Under the Highway Act, 15 per cent of the money appropriated is available for the improvement of roads in so-called small towns, and this money, in the opinion of the commission, has been of great value, not only to the towns themselves, but to the traveling public, by reason of the excellent facilities afforded in providing for connections with State highways. Massachusetts has about 17,500 miles of public roads. Of these roads about 12 per cent may be regarded as improved. Massachusetts has some of the best existing good roads, most of them surfaced with gravel.

MICHIGAN.—The Michigan Legislature is not in session this year, and no new legislation is pending or proposed. Of the 69,000 miles of public roads not more than 11 per cent are improved.

MINNESOTA.—A law was approved March 18th, 1911, which provided that within a reasonable time after January 1st, 1912 highway commissioners are to be appointed. All taxable property of the State will be levied upon to the extent of one-quarter of a mill for each dollar valuation, and the money so raised, together with all monies accruing from the income derived from investments of the internal improvement fund and from the construction of the State Road and Bridge Fund, together with other miscellaneous monies. The expenses of the commission are paid for by an appropriation of \$150,000 annually. There are about 79,500 miles of public roads, of which about 7 per cent are improved.

MISSISSIPPI.—No information could be obtained from the State authorities. Mississippi has less than 40,000 miles of public roads, most of them in wretched condition. Less than one per cent of the public roads of Mississippi may be regarded as improved.

MISSOURI.—The Legislature is not in session this year, so that there will be no statutory provision for the improvement of the roads. All told there are about 108,000 miles of public roads in the State, of which less than 3 per cent are improved.

MONTANA.—The State of Montana has no Highway Commission. Hence there are no data relating to the public roads of the State in any office in the capitol. The county commissioners are in charge of the roads within the boundaries of their respective counties. Some work has been done by convict labor. Montana is a very large State, with diversified topography, climate, and soil conditions, while the population is scattered from dense to extremely sparse. Road building is found in various stages of development. The total mileage of roads is about 24,000, but less than one-half per cent of the roads of the State are improved.

NEBRASKA.—It is the intention of the State Good Roads Association to present new bills for the creation of a State Highway Commission. The work of improving the State's good roads is to be put in charge of the office of the State Engineer, who will be intrusted with the general supervision of the engineering work. Various commercial clubs and automobile associations have accomplished much for the improvement of good roads. They are actually building and constructing good roads in different localities across the State from east to west. One of these highways is the Omaha-Denver Road; another the Omaha-Cheyenne Road, while a third runs north and south, being a continuation of the Meridian Road. At present the State Engineer has simply advisory power. There are about 80,500 miles of public roads in the State, of which less than 1 per cent are improved.

NEVADA.—Nevada is sparsely settled, and is an arid or semi-arid region. Her progress in good road building is not to be judged entirely by her percentage of good roads, because the need of such roads is not as great in Nevada as in many other States where the traffic is heavy and where the soil and climatic conditions necessitate hard roads. There are about 2,750 miles of public roads in the State, but less than 50 miles of these are improved.

NEW HAMPSHIRE.—The Office of Public Roads of the United States Department of Agriculture has issued Bulletin 244, entitled "New Hampshire Highways," from which we have gleaned the following information: New Hampshire has built a great many miles of gravel road, a few miles of native stone macadam and trap-rock macadam, and a small amount of bituminous macadam. Traffic conditions are unusual. In the warm season the roads are used mainly by automobiles. The last Legislature enacted a law which made a percentage of automobile fees available for the repair of roads. The \$1,000,000 bond issue was a splendid victory in legislation. It helped the road situation much. The State has appropriated money and has provided for the construction of three great trunk lines to be used by automobiles. That system will be an accomplished fact at the close of the present administration. What the State of New Hampshire needs is a system composed of little clusters of short roads which radiate and branch out from the cities back to the farms. The State has about 15,200 miles of roads, of which about 1,500 miles are improved.

NEW JERSEY.—There are two acts before the Legislature

for creating a State system of highways. These acts are almost identical, except that the one (Senate Bill 69) proposes to do the work through the State Highway Commission, whereas the other (Assembly Bill 58) proposes to accomplish the work through the present State management enlarged for the purpose. The second of the bills (Assembly 58) also provides for a little more elasticity in the financial system of the road department and to make it possible to transfer money from maintenance to construction or vice versa. New Jersey has not built any State roads, but under various acts has extended help to local bodies for the construction and maintenance of improved roads, and supervised their work. It has the power of approving of plans and specifications, and the Department of Public Roads has in this manner managed to enforce certain general requirements, and to influence the location of improved roads. This has resulted in giving the State probably the best State system of roads at a very low cost. The coming of the automobile has, however, so revolutionized road conditions that it is the universal agreement that a new system of building and maintaining roads must be adopted. This system is the object for which the two bills have been introduced. Assembly 58 is really a codification and amendment of existing State aid laws. New Jersey has about 17,000 miles of public roads, of these about 3,400 miles are improved.

NEW YORK.—New York has appropriated \$50,000,000 for a period of ten years, making \$5,000,000 available each year. The commissioners have stated that they will have \$22,000,000 available for work this year. In New York the trunk lines are built and maintained at the sole expense of the State, while other roads are built at joint expense, the State taking charge of the work and paying 50 per cent of the cost, the counties paying 35 per cent of the cost of the roads built in the county, and the town the remaining 15 per cent of the cost of building the roads in the respective towns. New York has about 84,000 miles of public roads, of which about 14,000 miles are improved.

NORTH CAROLINA.—Of the 48,285 miles of public roads in the State about 2,213 miles are improved. No information can be obtained from the State authorities.

NORTH DAKOTA.—A concurrent resolution was passed by the 1911 session of the Legislature providing for an amendment to the constitution which will enable the State to grant aid in the construction of highways. If this passes the 1913 session it will be submitted to a vote of the people, and if passed, laws providing for State aid in the construction of highways can be passed by the 1915 session of the Legislature. A law was also passed providing that the County Commissioners may at their option appoint a county superintendent of highways and deputy superintendents in organized counties, who shall have charge and supervision of the construction, improvement and maintenance of roads within said counties. A law was passed by the 1911 session of the Legislature providing for a license fee of three dollars for each motor vehicle operated, and the law further provides that the money received for licenses, less the cost of tags and clerical expenses, shall be returned to the county from which it originates to be used for maintenance and repairs of highways. The amount returned to the counties of the State for the year 1911 was \$17,061.05. Highway maintenance funds are secured by means of poll and property taxes and automobile and motor cycle licenses, as stated above. A poll tax of a dollar and a half is levied on every male person between the ages of twenty-one and fifty years, and a property tax from one to five mills on the dollar may be assessed by the county, which may be paid in cash or by labor at the rate of not less than one dollar and a half nor more than two dollars per day. The township may levy a maximum highway tax of eight mills on the dollar, which may be paid in cash or by labor at the rate of not less than one dollar and a half nor more than two dollars per day. The total mileage of public roads is about 62,000. Less than one-quarter per cent of the roads are improved. The need for stone and gravel roads is not so great in this State as in others farther south. Still, although the traffic is light, it is frequently impossible to draw large loads to market with a two-horse team in the winter months, because of the ice and snow.

OHIO.—The Legislature is not in session at the present time, and will not convene the present year. The Highway Department operates under a law passed at the last session. The improved permanent roadway will not be less than 10 or more than 20 feet in width unless for special reasons a greater width is desirable. The county commissioners or trustees of townships may also improve a highway in any way they see fit if they are willing to bear the expense. All highways which are improved must conform with the standard laid out by the State Highways Department. One-fourth of the cost and expense of improving roads is apportioned to the townships, who in turn apportion it among property owners along the road. An improvement of a highway made by the State in conjunction with a township will incur an assessment of 25 per cent of the total cost on the township and 15 per cent on the land abutting the highway. The highways are maintained and kept in repair by the State Highway Commissioner. Of the expense 25 per cent is borne by the State, 50 per cent by the county, and 25 per cent by the township. For the purpose of providing a fund for the payment of the portion of the cost and expense to be paid by the county, the township, or the township and county, the improvement, or repair of highways, the county commissioners are authorized to levy a tax not exceeding 1½ mills upon all the taxable property of the county. The payment of the cost and expense to be borne by the townships is to be paid for out of a tax not exceeding 5 mills on all taxable property of the township. The State has about 98,000 miles of public roads, of which about 28 per cent have been improved.

OKLAHOMA.—Ten years ago there were practically no improved roads in Oklahoma. Now there are about 400 miles of improved road. The total mileage of public roads is less than 72,000.

OREGON.—No information can be obtained from the State authorities. The total mileage of public roads is less than 30,000.

PENNSYLVANIA.—The State Highway Department is now operating under what is known as the Spruill Road Law, passed at the 1911 session of the Legislature. That law established a State Highway Department consisting of a State Highway Commissioner, two Deputy State Highway Commissioners, a Chief Engineer, a Chief Draftsman, Superintendents of Highways, and a staff of assistants and employees. The act provided for taking over from the counties of the commonwealth certain existing public roads connecting county seats, the principal cities and towns, and extending to the State line. These are described and defined by route numbers as the State highways of the commonwealth. The act relieved several townships or counties from any further obligation and expense to improve or maintain these highways. Boroughs in incorporated towns are required to maintain certain State highways wholly and in part. The act also provided for the purchase or acquisition of turnpike or toll roads forming part of or all of any State highway. The improvement of State highways is to be effected by contract, except where the State Highway Commissioner decides that the work should be done by the State. Aid is given by the State to counties and townships that desire to improve their roads. A certain percentage of the cost of improvement or repair is paid by the State, county, township, borough or incorporated town. A minimum width of State highways and State-aid highways is prescribed, as well as the kind of materials to be used in the improvement. Within the next year it is expected that between 200 and 300 miles of State Highways will be constructed. About 8,000 miles of roadway are affected by the new act, all of which must be taken over by the newly created State Highway Department by June next. All told there are about 88,000 miles of public roads in the State, of which 4 per cent are improved.

RHODE ISLAND.—In 1911 there was no new State road construction in Rhode Island. The State Board of Public Roads found it impossible to maintain the roads already built in a fairly passable condition with the limited

(Continued on page 252.)



Very early stage of the Blight; infection of twigs on top of tree. Note girdled twig, bearing withered leaves (upper right side).



Chestnut tree partly dead. Note sprouts with leaves near top, dwarfed leaves on middle branch, right side, and healthy lower branches and leaves.



Orchard chestnut nearly dead from Blight: showing characteristic withered leaves, which finally change to a brown tint.

The Chestnut Tree Blight

An Incurable Disease that has Destroyed Millions of Dollars Worth of Trees

Photographs by J. F. Collins and J. F. Brewer. Courtesy of Dr. Haven Metcalf, Division of Forest Pathology, U. S. Department of Agriculture.

WITHIN recent years the chestnut trees of the eastern part of this country have been attacked by a previously unknown disease which has already destroyed trees to the value of many millions of dollars, and which threatens the early extinction of the chestnut throughout the area affected. The chestnut blight, bark disease or canker, as it is variously termed, was first recognized as a serious disease in Bronx Park, New York city, in 1905, but it appears to have existed on Long Island since 1893. It has now spread into at least ten States and has practically killed all chestnut trees in the counties adjacent to New York city, and infected all in a much larger area, while foci of infection are scattered from northern Massachusetts and central New York to western Pennsylvania and southern Virginia.

The disease appears to be confined to the species of the genus *Castanea*. The American chestnut, the chinquapin, and the cultivated European chestnut are readily subject to it, but the Japanese varieties, which some investigators hold responsible for the introduction of the disease, show much greater resistance.

The bark disease appears sooner or later to exterminate the chestnut trees in any infected locality. Seventeen thousand large trees have been killed in Forest Park, Brooklyn. The financial loss already caused by the disease is estimated at \$25,000,000, half of which has been incurred in and about New York city.

The chestnut blight is caused by a parasite fungus named *Diaporthe parasitica*. When the microscopic spores, or reproductive cells, of this fungus enter a wound in the bark they produce a spreading sore which soon girdles the trunk or branch. If the trunk is the part affected the tree is killed, perhaps in one season, but if only small branches are attacked the rest of the tree may survive for several years. Infected limbs with smooth bark soon show dead sunken areas which enlarge and become dotted with yellow or brown fruiting pustules, about as big as a pinhead, which in a moist atmosphere extrude long twisted strings of yellow summer spores. These spores are disseminated by wind, insects, birds, squirrels, etc. The winter spores, which are found in late autumn, are disseminated in the same manner in the following spring.

Trees or branches that have been girdled by the fungus assume a very characteristic appearance. If the girdling is completed late in the season the leaves of the following spring are small and yellowish, while

if the girdling is completed in early summer the full grown leaves assume a peculiar red-brown tint, which may be recognized at a long distance.

Later, these leaves become darker and wither but do not fall for a long time. The burrs on a branch girdled in spring usually remain hanging during the winter, when they constitute the only conspicuous symptom of the disease. One of the most easily detected and most persistent symptoms is the growth of sprouts or "suckers" below the girdling lesions of trunk and branches, as well as at the base of the tree.

The disease is spread by the spores of the fungus

and unbarked timber. One of the most prolific sources of infection has been the transportation of diseased nursery stock.

The spores may develop in any moist hole in the bark. The hole may be a cut or wound, but by far the most common place of infection is a tunnel made by one of the insects known as borers, for these tunnels are moist even in dry weather. The development takes place in the inner bark and cambium layers, and the fruiting pustules are subsequently extended through the outer bark.

No method of producing immunity to the disease in



Complete destruction of chestnut trees by Blight. As yet no remedy has been found.



Tree casting shredded bark after death from Blight.

which are washed down from infected twigs to lower parts by rain, which may also carry them through short distances in general. As they are sticky they adhere to dust into which they are thus washed down, and this infected dust is carried to other trees by wind, but the spores, when free from dust, are not apparently disseminated by wind. They appear to be spread extensively by birds, especially woodpeckers, by squirrels and other rodents and by insects. The disease is carried bodily to great distances in tan bark

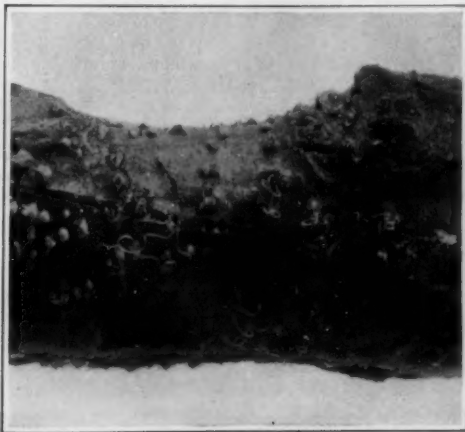
individual trees or of curing them when attacked has yet been discovered. The most effective individual treatment, however, would be of little value in the present situation, for it would not be practicable to apply such treatment to forest trees.

A method of controlling the disease which seems more practical and which has been tested with considerable success is outlined in Bulletin 467 of the U. S. Department of Agriculture. The investigations made by the department soon showed that the disease does not advance rapidly in a solid line but spreads from isolated centers, often many miles in advance of the main line of infection. It seemed probable that these centers of infection, if detected at an early stage, could be eliminated without great expense, thus materially checking the progress of the disease. During the last three years this method has been tested in the territory within about thirty-five miles of Washington. Fourteen points of infection were discovered and the infected trees were destroyed. Up to June, 1911, the disease had not reappeared at any of these points and at that date the experimental area appeared to be free from infection.

If this method could be applied on a large scale with equal thoroughness and success it would probably result ultimately in the control of the chestnut blight, but the carrying out of a comprehensive campaign of this sort is confronted by serious legal and other difficulties. The disease already exists in ten States, and threatens to exterminate the chestnut within its range. The issue, therefore, is a National one, but the Federal Government is not empowered to meet it. Each State must act for itself, and the efforts made to control the disease in any State may be seriously handicapped by



Bark of young chestnut tree, showing canker covered with wart-like pustules, which bear the minute spores of the Blight.



Pustules are here shown producing gelatinous threads, bearing summer spores of the Blight (enlarged).

the negligence of adjacent States. In most of the States, furthermore, it will be necessary to pass special laws and make specific appropriations for the control of the disease, as has already been done in Pennsylvania.

The first thing to be done in each State is to determine the exact range of the disease and, particularly, to locate the advance points of infection. This is the most difficult part of the programme because the work must be directed by experts in plant pathology and carried out by specially trained and trustworthy assistants. The diseased trees in the advance stage of infection must be destroyed or marked and all neighboring chestnut trees carefully inspected. Scouting may profitably be suspended between October and April, when the symptoms of disease are very obscure, but the destruction of marked trees may go on through the winter. The trees should be felled and barked and the bark and brush should be burned over the stumps—or elsewhere, if the stumps are barked down to the ground. The barked timber is not known to carry infection and it may, therefore, be shipped and used. This work of destruction does not require expert pathologists and can be best directed by the State forestry officials.

After all advance spots of infection are eliminated an immune zone must be established along the border of the area of general infection by destroying all chestnut trees, diseased or healthy, within a belt some ten miles wide, across which the disease is not likely to be transmitted. The chestnut trees behind this barrier may be abandoned to the disease but they should be felled and used as soon as possible.

Pennsylvania has set a praiseworthy example by creating a commission empowered to control the chestnut blight by such methods as may seem necessary, to order the destruction of diseased trees, to destroy such trees and assess the cost of destruction on owners who

do not promptly obey the order, to destroy healthy trees (with proper compensation to the owner) in order to check the spread of infection and to establish and maintain quarantine on chestnut products and nursery stock. Liberal appropriations are provided and penalties are prescribed for violation of the regulations.

The life of slightly infected ornamental or orchard chestnut trees can be prolonged for several or many years by cutting off small infected branches, gouging out diseased parts of large limbs and trunk and coating the wounds with tar. Spraying with any of the standard fungicides is powerless to check the disease after it has started in the inner bark but it may prevent infection from spores carried to healthy parts by rain or other agencies. Strewing slaked lime about the base of a tree and whitewashing the trunk and large limbs appear to have some effect in preventing infection and the ravages of borers. Trees should be carefully examined several times during the growing season.

In view of the uncertain future of the chestnut the Department of Agriculture advises against planting chestnut trees anywhere east of Ohio and warns western chestnut growers not to purchase stock from eastern nurseries. Owners of chestnut woodland within the area of general infection are advised to convert their trees into timber as quickly as possible, as the still living trees will soon die and rapidly deteriorate.

Outside this area careful inspection, prompt felling of diseased trees and burning the bark and brush over the stumps are advised in the owner's interest, even when not required by law. Owners of ornamental chestnut trees are warned against charlatans, who in many cases have extorted large sums for worse than useless treatment. Reliable tree specialists will have nothing to do with trees affected with the chestnut blight. The department will send copies of its pub-

lications relating to the chestnut blight, and typical specimens of diseased tissue (previously soaked in formalin to prevent infection) to all applicants, and will examine suspected specimens sent to it.

In conclusion, the bulletin lays stress on the great importance of protecting the chestnut forests of the South, the source of the best chestnut timber, where the blight has already appeared in a few spots.

A still less hopeful view of the situation is taken by Dr. W. A. Murrill, assistant director of the New York Botanical Garden, who investigated the blight when it appeared in Bronx Park and discovered and named the fungus which causes it. In the March issue of the *Journal of the N. Y. Botanical Garden*, Dr. Murrill criticises the action of the interstate convention recently held at Harrisburg in adopting resolutions in favor of a general campaign similar to that already begun in Pennsylvania. Dr. Murrill thinks that other States would be unwise to duplicate the costly Pennsylvania experiments or to adopt methods which have not been tested and are pretty certain to fail. He believes that the blight cannot be controlled in the forest by the cutting out method because it is practically impossible to locate all advance infections or to eradicate all those that are located and the secondary infections due to their widely disseminated spores. He says, moreover, that for ten to twenty years after the felling of the trees the disease would affect and be spread by sprouts from their roots. Dr. Murrill places little reliance on the published account of the extermination of the blight in the vicinity of Washington, and says that no tree or grove affected by the disease has ever been saved. He asserts, furthermore, that even if all advance infections could be eradicated, all of the foresters connected with the government and the entire army of the United States would be utterly powerless to oppose the progress of the disease in its main line of advance.

"Blowing" and "Sucking" Wells

THE term "blowing well" is applied to a well which, under certain circumstances, gives out a current of air from any small aperture at its summit. This current is often strong enough to lift and blow away light objects placed over the aperture, or dropped into the casing of the well. Its emission is frequently accompanied by a whistling, roaring or moaning noise, which may be audible at a distance of several rods.

As a rule "blowing" wells are also "sucking" wells, i. e., at times the direction of the air current is reversed, the air being drawn into the well. Cases are recorded, however, of wells that always "blow" and of others that always "suck," but these are rare. The term "breathing well" has sometimes been applied to the common type of well that both "blows" and "sucks."

Many years ago the foreign scientific journals described a number of wells at Meyrin, a little commune in the canton of Geneva, Switzerland, which were utilized as barometers by the inhabitants. These wells, which were very deep and were no longer used for drawing water, had been tightly blocked up with masonry except for an orifice of some three centimeters in diameter, through which air currents issued and entered in the manner above described. One of these had been fitted with a whistle, whereby the sound of its blowing was rendered audible at a great distance. The indraft of the air was regarded as a prognostic of fair weather; while strong blowing was believed to be a sure token of an approaching storm.

In recent years the occurrence of blowing wells has been reported at many places in Europe and America. Those in the United States have been studied by the Geological Survey, and their phenomena are now fairly well understood. The Survey has recently published the following statistics of the distribution of such wells.

Although the following list is probably far from complete, we may nevertheless infer from it that, com-

pared with the total number of wells in this country, the number that exhibit the phenomena of blowing and sucking is not large. It is not surprising, therefore, that such wells are looked upon as local marvels, and in some places are among the objects of interest regularly exhibited to tourists.

Inspection of the table also shows that such wells are usually deep, and that they exist in a great variety of materials, having various degrees of porosity.

The names "weather well" and "barometer well" often locally applied to wells that blow and suck reflect the popular belief that the behavior of these wells is governed in some way by the weather; and this belief is in the main correct, i. e., the phenomena, in a majority of cases, depend upon fluctuations in the barometric pressure, and these in turn are broadly related to changes in the weather. One of the first persons to test this hypothesis experimentally was Prof. J. T. Willard, of the Kansas State Agricultural College. Having heard of a well of this character at Winona, Kansas, he visited the spot, sealed the top of the well airtight by means of mortar and plaster of Paris, and inserted a small brass tube connecting the well with a gage. The latter consisted of a U-shaped glass tube, the bend of which for several inches up was filled with water. The fluctuations in the level of the water, read by means of an attached scale, indicated the direction and force of the air movement at the top of the well. By comparison with readings of a mercurial barometer it was shown conclusively that the air in the well exerted a pressure outward when the barometer fell, and yielded to the pressure of the outer air when the barometer rose. The explanation of the ordinary phenomena of sucking and blowing wells is, therefore, that a body of air, inclosed in the earth and communicating with the exterior by only one or a few small orifices, sets up strong outdrafts and indrafts in adjusting its tension to that of the air outside. It must not be supposed, however, that the inclosed body of air in question is merely that contained within

the well itself. The volume of the latter would probably be far too small to produce the violent effects observed. As Prof. Willard pointed out many years ago, each of these wells doubtless taps a subterranean reservoir of air, probably filling the interstices of sand or gravel beds. When the pressure of the external air is diminished some of this imprisoned air escapes, and the greater the fall of the barometer the greater the force with which the air is expelled. The fact that the majority of deep wells, closed at the top except for one or more small openings, do not exhibit the phenomena of blowing and sucking is, therefore, explained by the fact that they are not able to draw upon any considerable body of imprisoned air besides that contained in the well.

A serious result of the sucking process is often observed in winter. During the occurrence of high barometric pressure and its usual accompaniment, low temperature, a quantity of cold air is drawn into the well, and the water freezes, even at a depth of 100 feet or more below the surface of the ground.

The foregoing simple explanation of blowing and sucking wells does not apply to all cases. Fluctuations of water-level may doubtless give rise to similar phenomena. Suppose, for example, that a heavy fall of rain causes a general rise of the water-table in a water-bearing stratum of large area lying beneath an impervious stratum, the latter being perforated at only a few points by wells. The air imprisoned above an extensive sheet of water will thus be forced through a few small openings, each of which will be the source of a violent air current.

Fluctuations in the temperature of the outside air may also play a part in these phenomena. It is well known that many caverns, communicating with the outer air by small openings, blow in summer and suck in winter; the air within maintaining a nearly uniform temperature while that without varies with the season. According to Prof. Barbour, many observers notice a diurnal reversal of the air current in wells, corresponding to the diurnal period of the temperature.

Lastly, wells occur in which there is a continuous indraft, or a continuous outdraft. Two examples of the former exist in Georgia, and were described a few years ago by Prof. S. W. McCallie. In these cases, the air currents are entirely independent of atmospheric pressure, and are due to the friction of the air of a rapidly flowing subterranean stream of water. Prof. McCallie compares the action of such a stream to that of Richard's water air blast, found in many laboratories. The well forms the inlet for the air, and the rapid stream in the subterranean channel, into which the well opens, completes the conditions necessary for an ongoing air blast. As the air is constantly being drawn in at this point, it must escape constantly at some other point; if the latter happened to coincide in position with a well, we should have a well blowing constantly, without regard to the barometric pressure.

BLOWING AND BREATHING WELLS.

States.	Number of localities.	Depth feet.	Material.	Age of Material.
Arizona	One			
Arkansas	Several	*100	Limestone	Paleozoic
Indiana	One	120	Sandstone	"
Iowa	One	70	Gravel	Pleistocene
Louisiana	"	80	Sand	Tertiary
Michigan	"	"	"	Pleistocene
Minnesota	Many	50-150	Sand and limestone	Pleistocene and Paleozoic
Missouri	"	*170	Limestone	Paleozoic
Nebraska	"	*1,000	Sandstone, gravel and sand	Cretaceous, Tertiary, and Pleistocene
New York	Several	*150	Gravel and sand	Pleistocene
Oregon	One	300	Sand and sandstone	Tertiary
South Carolina	One	120	Sand	Cretaceous
Texas	Several	*200	"	"
Washington	"	*200	Lava beds	Tertiary and Pleistocene
Wisconsin	One	100	Sand	Pleistocene

*Depth of deepest well here listed for the State.

WELLS HAVING CONTINUOUS INDRAFT.

States.	Number of localities.	Depth feet.	Material.	Age of Material.
Georgia	Two	100-150	Limestone	Tertiary

Brucker's Trans-Atlantic Airship Expedition Getting Ready

From the Verde Islands to Barbados With the Trade Winds

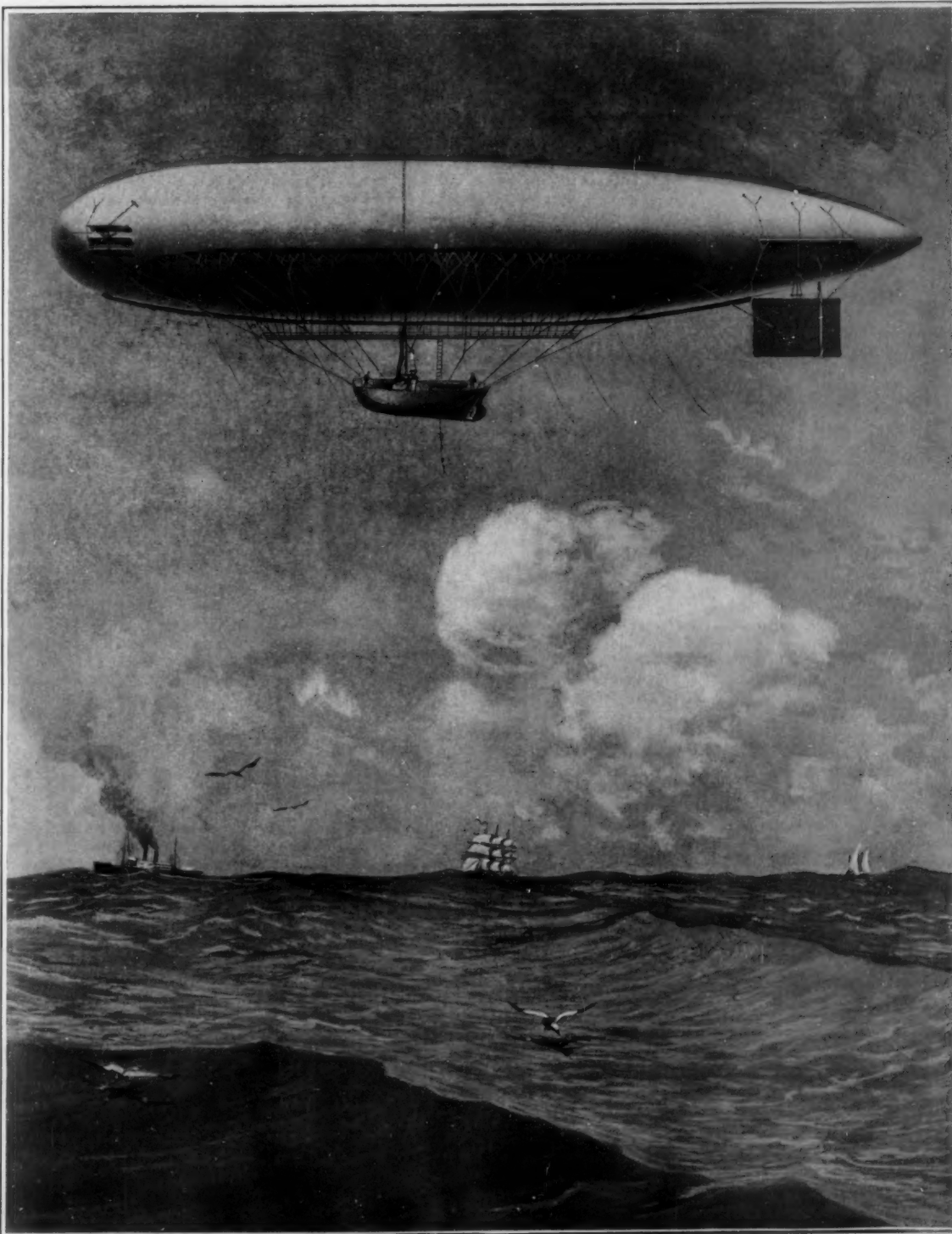
MR. JOSEPH BRUCKER'S attempt to cross the Atlantic in a dirigible is especially characterized by its business-like methods. Although the task that he set for himself was from the outset easier of successful accomplishment than that of his rivals, Messrs. Wellman and Vaniman, and although, by the locality and time of his flight, he excluded absolutely any chances of meeting with storms, rough sea or bad weather of any sort, and also selected a shorter route, he first of all provided for the greatest possible safety of the crew in case of accident, by making the whole car of his airship, containing all the equipment, stores, instruments and the living accommodations, a thoroughly seaworthy motor-driven yacht, with two separate engines, also with mast and sails, that by tried and perfected methods can be launched with safety from the air into the sea at any time and at a moment's notice. This has been repeatedly demonstrated by launching the boat with its whole crew and equipment from a frame, to which it was suspended exactly in the same way as it will be suspended from the balloon, and which was carried on the side of a moving steamer, at the level of the boatdeck. Major Von Parseval's invention enabled Brucker to concentrate all his machinery and equipment in one car, which it was easy to turn into a staunch watercraft. When the boat is launched from the balloon, water-anchors are used to hold the latter pointing into the wind and to slow down its speed. Thus the boat can never hit the water broadside, or at a speed of more than ten miles an hour.

In spite of these fundamental precautions, Mr. Brucker and his advisers, noted experts in German aeronautics and meteorology, have been themselves the most skeptical critics of their chances. Their airship "Suchard" has now been reconstructed three times to keep abreast of the most recent advances and experiences in dirigible navigation. From the outset they trusted only to a perfected and well tested type and so built their ship after the Parseval model. When the method of launching the boat had been thoroughly tried, the next and most severe tests were applied to the power plant and the propelling machinery. After

endurance trials the first equipment was condemned as being unfit to guarantee reliability during an air trip of unprecedented duration. Yet before the necessary alterations had been completed, it was decided that the principle upon which the whole airship had been designed, needed correction, if the experience gained in

ship really in hand, because changes of temperature might take it very suddenly out of reach of the ocean's surface. Yet another fundamental weakness of the first plan was discovered—the old "Suchard" was so slow and depended so much on the help of the gentle undulating trade winds, that any trial trips in Germany might have ended in quick disaster if the weather had not remained quite unusually calm. To remove all these difficulties at once, it was decided to make the "Suchard" a comparatively fast dirigible by completely rebuilding the balloon part.

The old envelope was 60 meters (196.9 feet) long, with a greatest diameter of 17 2/5 meters (57.1 feet). The new one, of the best speed lines, is 76 meters (249.3 feet) long with a greatest diameter of only 15 1/2 meters (50.9 feet). The reconstructed machinery is identical with that of the famous and successful "Parseval VI," whose motors never broke down during a total run of 4,000 miles. While in the old "Suchard" only one motor could drive the propellers at a time, the other being in reserve, in the new, both may drive at the same time, also both may drive one propeller, or one motor both propellers. This great flexibility results from the variable pitch of the Parseval propellers now employed. A speed of 8 1/2 meters a second is calculated after the Parseval's approved formula, with one motor, and of 12 meters a second with two motors driving. The true value of this maximum speed lies not so



BRUCKER'S AIRSHIP WITH WHICH HE HOPES TO CROSS THE ATLANTIC

the recent aerial passenger service in Germany was to be made a guarantee of success in so big an undertaking. Mr. Albert Simon, a leading engineer, and designer of the Parseval Company, had not long taken charge of the reconstruction of the "Suchard's" power plant on Parseval lines, before the very core of the problem involved in any ocean-crossing trip by airship was laid bare to the promoters of the Brucker expedition—the task of preventing all gas losses resulting from gas-expansion due to the sun's heat and the subsequent ascension to great altitudes. Barring such losses, it was easy to prove that the "Suchard" could be kept in the air for a week or more. In the light of many recent experiences, it was realized that scooping up water ballast was not sufficient to keep the air-

much in making rapid headway (the motors would be strained if it were long continued) but in the unexpected strong lifting or depressing effect it has been found to exert under the action of the horizontal steering planes, which exceeds that of horizontal propellers. It will keep the airship forcibly up or down, if between cloud shadows and bright sunshine the gas lift should suddenly vary, until permanent equilibrium is restored by scooping water ballast. This is not a theory but a well tried practice of Parseval ships. Brucker's original plan of cooling the gas by spraying the envelope is as yet too experimental to be trusted in a question on which the success or failure of a trans-Atlantic flight principally depends. As an auxiliary means of

(Concluded on page 256.)



A section of the present main State road, flooded as the result of defective drainage.

The Coleman du Pont Highway Through the State of Delaware

An Object Lesson in Road Building and Maintenance

By Coleman du Pont



This shows a Delaware road which will give place to the new State highway.

IN determining the place to locate the new highway through the State of Delaware, which will be 110 miles in length, it was the desire of the builder to locate it where it was most desired by the people, and in order to get a true expression of opinion it was decided to build it where the greatest number of feet of right-of-way was offered free. Not that the cost of right-of-way was an item of much importance in comparison with the cost of the road; because a strip forty feet wide would take only a little more than two acres to the mile, and the value of the land in the lower county will not average fifteen dollars an acre; so that the cost of right-of-way would not be of sufficient amount in the total cost to be worthy of much consideration.

This road, the surveys of which are practically completed, will start on the Pennsylvania line in the north-eastern part of the State and run thence following in a measure the contour of the country, mainly by long, easy curves and grades through the rock bound hills of New Castle County to the city of Wilmington, first through the residential portion, then over the historic Brandywine and into the heart of the city, tourists having the choice of half a dozen routes through the city proper. Then crossing the Christiana, the stream on which the shipyards and steel mills are situated, it will go a little east of due south to the town of Selbyville, using in many places the old Kings Highway, a road which has been established for three centuries. From Wilmington in a southerly direction it will pass near the old and historic town of New Castle, rich in colonial legends, at one time the largest and most prominent town on the Peninsula. Owing to its not being located on a railroad or a thoroughfare of any kind, except the Delaware River, this town has decreased in population for the past fifty years. After leaving New Castle and seven or eight miles below, the road crosses the Delaware and Chesapeake Canal near St. Georges, a small village at which the second locks of this canal are located. The difference in eleva-

tion of water at these locks is ten feet, and as a matter of interest to the reader, it is one of the first canals suggested to be taken over by the Government in the Inland Waterways plan. The next town of any size is Odessa, which also, being off the main line of the road, has many disadvantages, and so thoroughly have the people of this town appreciated the value of the road that they have offered to give a right-of-way to the Boulevard Company through the heart of the town. From Odessa it passes in a perfectly straight line to Smyrna, another old and well known Peninsula town. Continuing in almost a straight line it goes from Smyrna to Dover, the capital of the State. Here it passes to the rear of the old State house, in sight of the famous (it is hoped soon to be discarded) whipping-post. From Dover it passes near the small villages of Frederica and Magnolia to Milford (Milford and Dover are the largest towns in Delaware south of Wilmington). From Milford it goes in almost a straight line to Georgetown, the county seat of Sussex County. Georgetown, too, is one of the oldest towns on the Peninsula and famous in colonial days, many of the families there tracing back two hundred years on the same farms. From Georgetown it passes near the towns of Millsboro and Dagsboro to Selbyville, the limits of this last and most enterprising town being the Maryland line. From this point the Maryland County Commissioners have agreed to construct a road through Berlin to Princess Anne on the Virginia line. It is hoped that Virginia will take up the road at her northern line and carry it through to Cape Charles. Senator Sproul, the author of the famous Sproul road bill in Pennsylvania, and Mr. Bigelow, the State Road Commissioner, have promised to meet the road at the Pennsylvania line and build or rebuild a good road to Philadelphia.

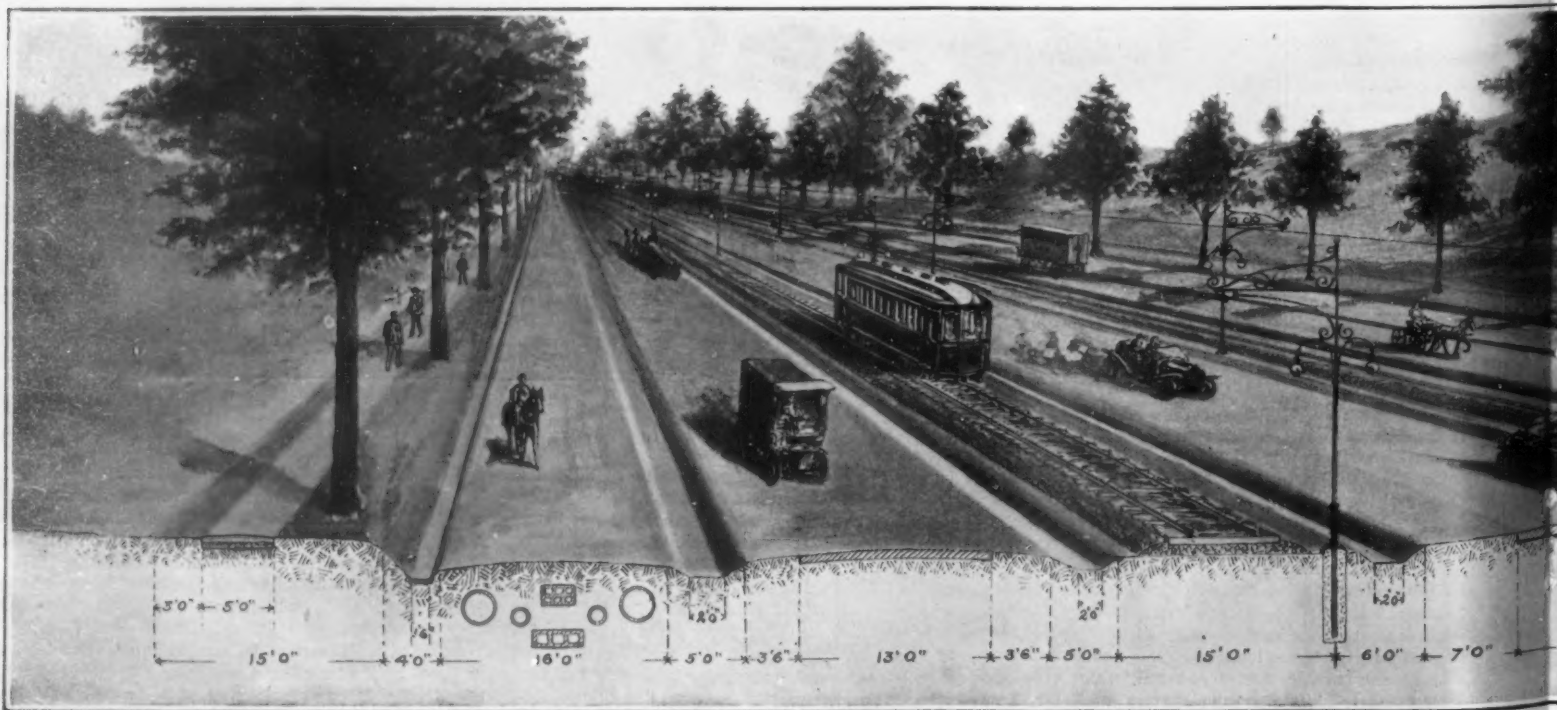
The du Pont road will be constructed of waterbound macadam or concrete base, on top of which will be laid asphalt and stone mixed, or a surface composed of waterbound macadam with a half-inch covering of

asphalt and trap rock to make it dust and water proof. There will be several types of the latest known roads built; so that in the future cost of maintenance can be ascertained, and this road will serve as an example for cost of construction and cost of maintenance for many other States that are interested, as it is the purpose of the company building the road to keep very accurate and elaborate costs and to do what it can to keep maintenance cost in the future and make these figures public.

The width of the road will vary to take care of the variation in travel on the road. The narrowest part will be 20 feet wide, 13 of which will be "metal." The curves will be limited to 5 degrees, and this will be used only where it is necessary on entering towns or overcoming natural obstacles in New Castle County.

When the law passed the Delaware Legislature enabling any corporation or any person, for that matter, to build a road through Delaware, it was the first time that anything of this kind had been attempted anywhere, therefore the bill was not as perfect as one drawn to-day, with this practical example before us, should be. Some of the mistakes are given here, in order that others who may undertake this form of philanthropy may profit by it. For instance, under the laws of Delaware, which allow the right of eminent domain to trolley roads, when property is condemned the suit must be carried through and finally adjudicated by the courts before work can progress on the property condemned; whereas the law should read, as it does in many States, that the company or builders of the road could file a bond satisfactory in form, amount and in any way required by the court and go ahead with the work. Otherwise the road cannot be built quickly; because, without the assurance of a right of way, no contractor will bid and, therefore, until after the court's final decision and condemnation proceedings, no contract can be let.

Another point to be guarded against in future enterprises of this kind is that, in considering the damages

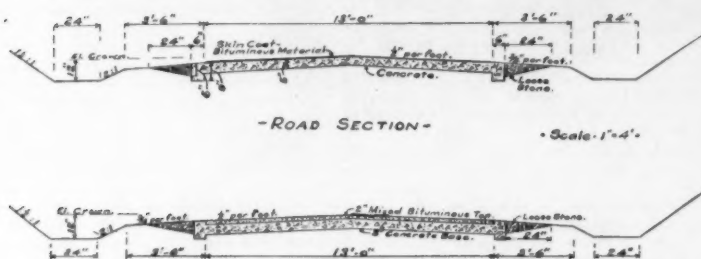


The right-of-way of the du Pont road is 200 feet wide. At present the central 40 feet is being constructed as a first-class road. As the country develops

THE TWO-HUNDRED-FOOT HIGHWAY



A section of the du Pont highway ready for the top dressing.



Sections of two of the various types of road which will be built on the State highway.

to the property required by the road, the viewers or commissioners should take into consideration the value of the road to the property. In many instances, peculiar as it may seem, the owners of land practically say, "Yes, our land has been increased in value 100 per cent by reason of the road locating there, but we do not see why we should give any land for right-of-way because, if the road requires land in order to build, this land should be purchased." The land owners in four or five instances acknowledge themselves the benefit to their property to exceed 100 per cent; but in the face of this it is necessary to condemn them in order to acquire right-of-way at a reasonable figure.

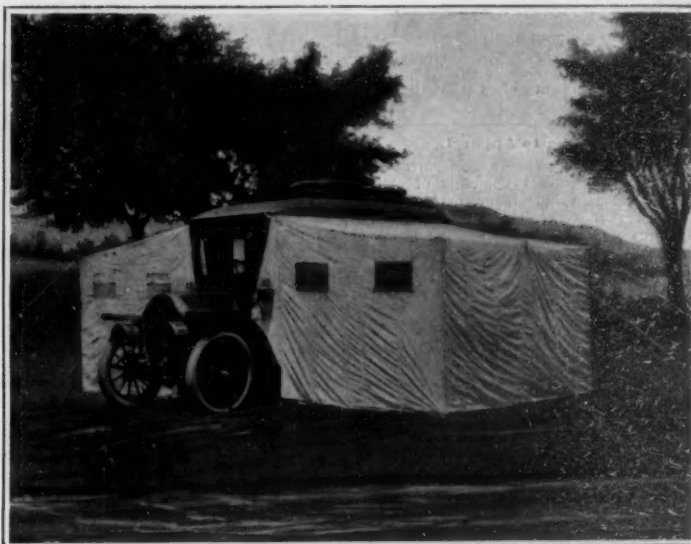
The geological formation of the Delaware Peninsula is clay and sand; in many places the sand is 20, 30, and 40 feet deep, and water is nearly always reached in less than 16 feet. The country generally speaking is flat or slightly rolling; a hill of ten or fifteen feet occurring on the public roads is invariably known in the lower counties as the "Big Hill." In only one place in Sussex County does gravel occur in sufficient quantities to build three or four miles of road. This is of too fine a quality and so unreliable in deposits that it cannot be counted on for much assistance in the building of good roads. No stone formations of any kind occur in the two lower counties or the southern part of the upper county of Delaware, while, in the northern end of the State, granite is plentiful.

The soil for farming purposes and the climatic conditions are all that can be desired, particularly for fruit growing. From one shipping point alone sixty-two carloads of strawberries and sixty-three carloads of peaches were shipped in one day. At the two nearest stations to this point, which are respectively about

four miles north and four miles south, on the same day probably two-thirds as many cars were shipped. The land seems better adapted for small fruits and vegetables than for corn, wheat or grass. One is surprised in going through lower Delaware to see the lack of meadows or fields of any kind from which hay can be gathered. To 90 per cent of the animals that work on farms fodder is the only rough feed known, the blade fodder and top fodder still being gathered before the corn is ripe and cured for rough feed for the farm animals during the winter.

A strip of land 200 feet wide, extending from one end of the State to the other, will be acquired by the company which is building the road. While only forty or fifty feet of this will be used for road-building purposes at present, it is hoped that the whole 200 feet will ultimately become one of the great highways of the United States. The more great highways that are built in the United States, the better off the United States will be; for nothing educates people faster than good roads. Until such time as this extra land is needed for widening the road or for public utilities of some kind, such as a trolley road, it will be devoted to experimental work; stations will be established in charge of graduates of agricultural institutions, the Grange will be asked to meet at these stations and arrangements will be made for lectures to be given on the latest known scientific methods of farming.

Farming by steam is done on a large scale in the West, and it is part of the builder's plan to show that steam farming can be done economically in the eastern States as well as in the West, particularly by co-operation among the farmers. For instance, many of the farmers in Delaware to-day plant more than one hun-



To enable him to spend several days inspecting the new road, Coleman du Pont has had built the above car, which provides comfortable eating and sleeping accommodations.

Camp car with tent attachment set up.

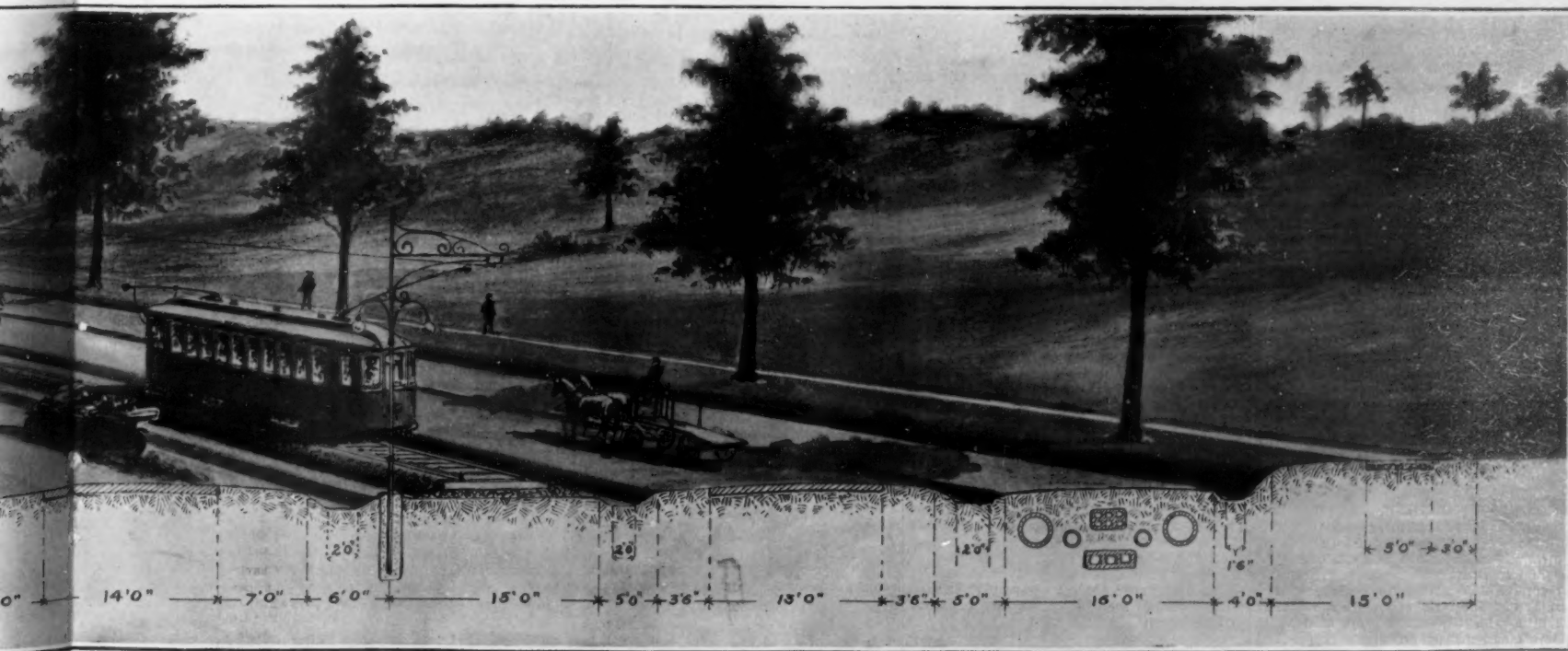
dred acres of wheat. If four farmers, whose property joins, let us say at a common point, would plant their wheat in adjoining land, assuming each had 150 acres, this would make six hundred acres of wheat to be planted; and on a field of that size, there is no question of the economy of steam plowing as compared with plowing by animal power.

The writer believes that in the near future a farmer will no more think of planting a crop in a certain piece of land without first having it analyzed than an iron founder would think of failing to analyze each heat in his foundry. No reputable manager of an iron foundry would think of running a heat without taking a sample of each heat, and it is by daily analysis, scientific methods and careful record keeping that the steel business has developed into the important business it is to-day. Experiments will be made in plowing with steam and gasoline and with intense cultivation. The various fertilizers will be experimented with at these stations, and the income, if any, from that part of the land not occupied by the road will be, through some channel, directly or indirectly, used toward developing the resources of the State.

The photographs and sectional drawings, illustrating this article, are sufficiently explained by the titles.

The writer believes that nothing can do more good than money spent in building or improving roads in the United States. He believes that, in the next twenty-five years, there will be more money spent in building good roads than there has been spent in building steam railroads in the past twenty-five years, and that the money thus expended will do the country as much, if not more, good than if spent in railroads.

(Concluded on page 255.)



ry develops, trolley tracks, roadways for heavy freight traffic and footwalks will be added. The above drawing suggests the possible ultimate lay-out of the whole highway.

T HIGHWAY THROUGH THE STATE OF DELAWARE

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

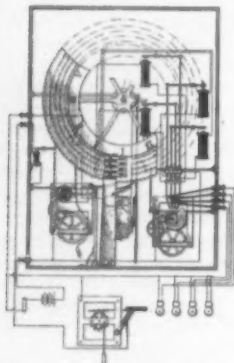
Pertaining to Apparel.

PLACKET FASTENER.—In this patent the invention has reference to plackets of skirts and its object is to provide a new and improved placket fastener, arranged to securely hold the placket closed when the skirt is worn and to permit the wearer of the skirt to conveniently close or open the placket.

Electrical Devices.

TERMINAL PLATE FOR TELEPHONE DESK STANDS.—G. NELSON, 1683 54th Street, Brooklyn, New York, N. Y. This invention provides a terminal block which may be quickly and readily removed from the plate for repair or alteration; provides a plate constructed from insulating material in a manner to prevent leakage of current incident to construction of this kind; provides a simple and efficient mounting for the contact members; and to simplify the construction by eliminating the bushings at the binding posts and insulating strips between the contact spring prevalent in the usual construction.

ELECTRIC PROGRAM CLOCK.—A. L. RONELL, Fort Dodge, Iowa. This clock is suitable for use in schools, military headquarters, public offices, and in all situations where it may be desired to periodically actuate a number of separate alarms located some distance apart; as for instance, in different rooms or parts of a building or buildings. The invention embodies improvements over the inven-



ELECTRIC PROGRAM CLOCK.

tion described in two former patents granted to Mr. Ronell. The present patent embodies a number of improvements for general purposes and losses of energy incidental to ringing of bells and operating various numerous parts in other systems, are in this apparatus almost entirely eliminated. The invention is shown in the engraving which is a view in vertical cross section and partly diagrammatic showing the entire construction and wiring.

SIGNALING SERVICE.—C. A. SCHINDLER, 287 Pallade Avenue, West Hoboken, N. J. The object of this invention is to provide a device arranged on a glove or other garment worn by the driver of an automobile, and arranged in such a manner that the signal can be readily displayed during the night whenever it is desired to turn out or to stop the vehicle, or for other purposes. Use is made of an electric signaling lamp carried on the glove, or other part of the apparel and an electric circuit connected with the lamp, and having a switch provided with contact points.

Of Interest to Farmers.

CULTIVATOR.—J. J. RAMPLEY, Carnesville, Ga. The purpose here is to provide a lister or double mold-board cultivator adapted for lateral adjustment to form lists of furrows at different distances apart; and a further object is to provide improved means for effecting such adjustment and for securing the shovel beams or standards firmly, and rigidly in any adjustment.

PLANTER ATTACHMENT.—H. KILI, care of Hubbard & Schmiedes Kamp, 13 Stern Building, Quincy, Ill. In this instance the invention is an improvement in attachments for planters of the check row type, and has for its object the provision of a simple, inexpensive device for use in returning the wire pulley of the planter to place after it has been thrown loose to turn at the end of the row.

THRESHING MACHINE.—H. M. BOE, Hampden, N. D. Among the principal objects here are: to provide means for winnowing the straw, chaff and grain in a threshing machine and to deliver the same across an air blast intermediate the grain conveyors of a threshing machine; and to provide a vibrating mechanism which is simple and efficient to counterbalance the weight of the upper and lower separating racks.

METHOD OF FORMING HOLLOW GLASS ARTICLES.—K. JUNG, Grosspriesen-on-the-Elbe, Bohemia, Austria. The invention re-

lates to glass blowing, the more particular purpose being to produce coloration effects in the manufacture of glass articles, such as globes and shades made to represent flowers. It also relates to the manufacture of so-called "dashed" glass articles, having any desired pattern, means provide for destroying and distributing the thickness of the glass and consequently to effect the variations in color.

HORSESHOE.—W. RUFF, 467 Columbus Avenue, New York, N. Y. In the present patent the invention relates to horseshoes, and it comprises improved means which can be readily attached to the bottom of the shoe to prevent the animal wearing the same from slipping or falling on the streets or on other thoroughfares covered with ice and sleet.

ADJUSTABLE STALL.—O. B. STILLMAN, Washingtonville, Orange County, N. Y. The purpose here is to provide a stall, preferably a cow stall, so constructed that the length thereof can be readily changed to suit the size of the animal occupying the same. By means of this improvement the sizes of cows which vary from four and a half to six feet in length are adapted to the size of the stall which is varied to suit the length of the cow, and each cow is held in proper position with respect to the trough.

INSECT CATCHER.—Address HERRING BROS., Bolton, Miss. This invention is particularly designed for use in catching insects such as the boll-weevil which infest the cotton plants. An object is to provide a device which may be drawn along between the rows of cotton, and which will engage the bushes so as to shake them and cause the insects to fall into the receptacles.

ATTACHMENT FOR ELEVATED POTATO DIGGERS.—G. W. COOPER, Patten, Maine. The present digger is related to the class described in a former patent granted to Mr. Cooper. The object is to provide improved means for distributing and separating the potatoes when they are emptied into the barrels, and a further object is to construct the machine so as to facilitate the carrying of the empty barrels which are to be filled.

Of General Interest.

LINK GUARD.—S. S. PIER, Natchez, Alberta, Canada. This improvement is in links such as are commonly used for suspending a charm or other pendant from a watch or other chain, and the invention has for an object to provide a novel construction of link guard which will include as an additional safety, a spring guard crossing the link



LINK GUARD.

within the same, held at one end to the link and free at its other end, where it presses yieldingly against the opposite side of the link as the free end of the guard spring may be pushed out of the way to permit the intentional passage of a hanger link in placing the same on and removing it from the main link. A side view of the link embodying this invention is shown in the engraving, with the guard spring in closer position.

GUN SIGHT.—A. A. GERMAN, 410 Exchange Building, Duluth, Minn. Among the principal objects which the present invention has in view are: to provide an attachment for the peep sight of a gun, adapted for rapid and easy adjustment for changing the size of the opening, and to provide a construction for an attachment of the character named which is simple and durable.

EAR PROTECTOR.—J. A. R. ELLIOTT, P. O. Box 201, New York, N. Y. This invention has reference to means for the protection of the ears from excessive pressure due to concussion caused by the discharge of fire-arms or other causes, and the protection of the organs of the inner ear from excessive or injurious vibrations, and to indirectly protect the entire nervous system from shock by severe sound.

METHOD OF PRODUCING ART PLAQUES.—C. O. HENRIQUES, 662 Ocean Avenue, Jersey City, N. J. The aim in this case is to provide a method of producing art plaques having a colored picture incorporated in the face of a body of plastic material without the use of a sheet of paper or other carrying medium, thus insuring the production of a highly artistic effect.

KITE.—O. SEYDEL, 321 East 18th Street, New York, N. Y. This invention refers to aeronautics and the object is to provide a kite arranged to insure easy rising from the ground and proper flying in the air, and to

permit of conveniently folding the parts into a comparatively small bundle for carrying the kite from or to the field or to extend the parts quickly and accurately without the use of tools.

ATTACHMENT FOR FOUNTAIN PENS.—A. NAPOLITANO, General Delivery, New York, N. Y. This attachment securely holds the pen in a vest or other garment pocket. It is a spring bar provided at one end with a claw or prong and at the other so constructed as to adapt it to be secured to the body or cap of a fountain pen. A special feature is the construction of the free end of the same whereby it is not only adapted to engage the clothing, but to be readily detached when it is desired to withdraw the pen.

SEALED PACKAGE.—J. W. HENSON, Scranton Lace Co., 141 5th Ave., New York, N. Y. The purpose of the inventor is to provide a new and improved sealed package, more especially designed for containing lace curtains and other articles, and arranged to protect the articles against dust and light while being held in stock and stored on shelves and other places.

LADDER BASE.—W. ROGERS, Martha, Va. Among the principal objects in view in this invention are: to provide means operatively connected with a ladder whereby the same may be adapted for employment where the resting ground is uneven in surface; and to provide leveling or righting members for a ladder adapted to shift the perpendicular balance of a ladder.

DENTAL SWAGE.—J. B. SEDBERRY, Thompsons Station, Tenn. This invention is an improvement in swages, and has for its purpose the provision of a device of the character specified especially adapted for dentists' use, and by means of which swaging of all kinds may be expeditiously and easily performed. Plates of any material may be swaged, either gold, platinum or silver.

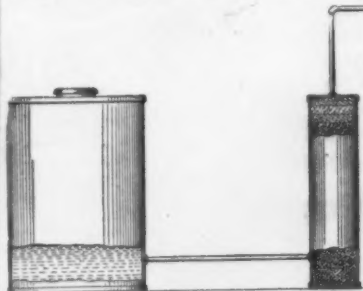
METALLIC SKELETON SPACE BLOCK FOR GIN SAWS.—Address W. C. HENDRIX, 917-922 Atlanta National Bank Building, Atlanta, Ga. This invention is an improvement in space blocks for spacing apart the saws of a gang and is especially designed for use in spacing apart gin saws. The object is to provide a form of block in which the members thereof are yieldable laterally independently of one another, also wherein is provided a circular series of spacing members which surround the axis of the block and are loosely confined, the axes of the several rings of the series being approximately parallel with the axis of the block.

FOLDING EYE-GLASSES.—E. P. HUTTEN, East Rutherford, N. J., and J. McDUGALL, New York, N. Y., care of E. P. HUTTEN, 56 Lincoln Place, East Rutherford, N. J. The purpose of this invention is to provide new and improved folding eye-glasses provided with angular nose clips and arranged to permit of folding one lens over the other without hindrance by the projecting clips and without unduly straining the spring pivotally connecting the lens frames with each other.

COMPOSITION BUTTER.—L. O. FOX and O. A. FOX, care of Mrs. O. A. FOX, Woodland, Idaho. This improved composition butter is free from all deleterious chemicals and other similar substances. It possesses all of the flavor of ordinary butter and is very similar to the same but can be made relatively cheaper, and at the same time is highly preservative and healthful and can be used for all purposes for which ordinary butter is used.

MOLD.—W. PARKER and L. E. CAMPBELL, Neola, Iowa. For the purpose of this invention a mold is employed having a base, slides carried thereby and removable therefrom, end pieces removably associated with the slides and adjustable means for holding reinforcing members within the mold so that they can be substantially embedded in the material forming the fence post or other body.

PURIFYING DEVICE FOR HYDROCARBON FUEL GASOLINE.—O. A. BENKENDORF, Helen, New Mexico. In this case the object is the provision of a simple, economical device for thoroughly purifying hydrocarbon liquid fuels, as, for instance, gasoline, by removing mechanically the solid impurities, and by utilizing the water impurities chemically in



PURIFYING DEVICE FOR HYDROCARBON FUEL GASOLINE.

such manner as to enrich the fuel. The present invention is designed to be interposed in the system between the supply tank and the place of utilization of the fuel. In the accompanying engraving a drawing is shown of

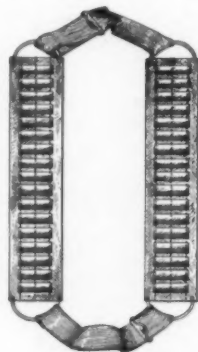
a side view of a simple embodiment of the invention, parts thereof being in section.

EVAPORATING PAN.—R. G. HAMILTON, Route No. 1, Tryon, N. C. An object here is to provide a device in which there is a series of baffles for causing the flow of the liquid to be evaporated from one side to the other of the pan, the baffles being held in place securely, but without the use of solder, rivets or nails.

PEGWOOD SHARPENER.—A. C. FISHER, Cedar Rapids, Iowa. This invention is a device or apparatus for pointing or sharpening pegwood which is used by watchmakers in watch repairing; but the invention is also applicable for pointing pencils. The entire operation is effected by one hand or without the necessity of employing both hands as required in the ordinary operation of sharpening pegwood.

VAPORIZING AND AIR HEATING ATTACHMENT FOR BATH CABINETS.—Address, ROBINSON & ROBINSON, 410 Continental Building, Denver, Colo. This improvement is designed as an attachment for cabinets used for administering vapor baths, and the apparatus is in the nature of a heater adapted for generating steam or medicated vapors and directing them into the cabinet. The attachment is portable and, in practice, is suspended beneath the cabinet.

CARTRIDGE BELT.—F. ROBBIE, Ashland, N. H. This invention relates to an improved form of cartridge belts, and more particularly relates to that class of belts adapted to extend over the left shoulder and under the arm. An object is to provide a belt of two cartridge-carrying parts, so constructed that ready access may be obtained to the car-



CARTRIDGE BELT.

tridges. Further, to provide a device so arranged that when the cartridges are exhausted from the front portion of the belt, the latter may readily be drawn about to bring the portion of the belt containing the cartridges in front of the body of the wearer. The illustration herewith gives a plan view of the belt spread open.

APPARATUS FOR ABSORBING HYDROFLUORIC ACID.—J. J. DYE, care of HUGGER BROS., 723 Bell Building, Montgomery, Ala. This invention pertains to the manufacture of commercial acid phosphate, and its object is to provide an apparatus for condensing the obnoxious and destructive gases or fumes arising in mixing phosphate rock with an acid, the apparatus being arranged to convert gases into solid form and prevent the same from escaping into the atmosphere to the detriment of human beings and vegetation.

Hardware and Tools.

NUT LOCK.—I. C. HAWES, R. F. D. No. 1, Gaylordsville, Conn. This improvement has reference to nut locks, and it has for its object to provide one having few parts, which may be manufactured at little expense, the lock being so constructed that it may be readily secured with a certainty that it will remain in place until it is removed at the will of the mechanic.

NUT LOCK.—J. J. HERZOG, 108 Clay Street, Baltimore, Md. The improvement is in nut locks in which a soft metal washer or bushing is used with a nut proper, the two being made and sold as separate articles and applied separately to a bolt. The nut and the soft metal washer in the present invention are so constructed and connected as to form a single article of manufacture adapted to be sold and used as such.

THREADING TOOL.—J. M. CARPENTER, care of Carpenter Tap & Die Co., Pawtucket, R. I. The invention relates particularly to an attachment for threading tools, by means of which the stock, that is, the shank of the bolt or other article to be threaded, is held in proper relation to the die of the tool in order to prevent the thread from being cut obliquely or skewed, when the tool is used.

SOLDERING IRON.—J. E. ROWE, 8 Charles Street, New York, N. Y. This invention pertains to a self-heating soldering iron which is adapted to be heated by a gas supplied from a suitable vaporizable fluid stored in the body of the device. Means are provided whereby the fluid to be vaporized may be freely and positively fed without danger of intermixing air.

Why the whole World pays tribute to the



What is the source of that mysterious enthusiasm which makes everyone speak in superlative terms of the Cadillac?

What peculiar qualities does it possess, which impel the public to dismiss impatiently the suggestion that other cars are "as good as the Cadillac"?

What advantages does the Cadillac owner enjoy, day by day, which convince him that his is incontestably the better car?

Why do Cadillac dealers everywhere encounter a lively disposition to compare the Cadillac with the costliest cars; but not with cars of like or half-way higher price?

On what basis can we explain the phenomenon, encountered everywhere, of men reverting to the Cadillac, from cars costing two and three times as much money?

The Primal Cause of Cadillac Efficiency

The subject is a big one; it cannot be compassed in a brief advertisement.

But the source of Cadillac satisfaction can be indicated.

We can trace the cause; and we can partially picture the effect.

Let us take, merely as an example, separating it from all the rest—one, big, little fact.

Every Cadillac piston and every Cadillac cylinder is interchangeable with every other Cadillac piston; and every other Cadillac cylinder.

More than 400 essentially accurate dimensions in Cadillac parts are measured down to one one-thousandth of an inch.

Johannson of Eskelstuna, Sweden, is the inventor of the most wonderful system of limit gauges for infinitesimally fine measure-

ments the world has ever seen—gauges which are accurate to the one ten-thousandth part of an inch.

The Cadillac Company is, and has been for years, the world's foremost exponent of its own; and of the Johannson system.

Cadillac adherence to unexampled accuracy ante-dates the Johannson discovery. It goes back forty years to its inception—ten years, in its application to the Cadillac car.

So here you have the primal cause—the source of that worldwide, mysterious, Cadillac enthusiasm—the despair of cars which may look like, but are not like the Cadillac; because they have not wrapped up in them the fervor and the lifetime devotion inspired by an ideal.

Effects which follow the Primal Cause

And now as to the effect.

How is the inherent difference of the Cadillac expressed in its outward behavior—how does it differ and how does it surpass?

In a hundred ways; some of them intangible, but ever-present; many of them intensely practical—things you can see and feel and know.

The first fruit of fine measurement and perfect alignment is, of course, the reduction of friction to the closest possible approach to a theoretical zero.

Friction is the worst and most relentless enemy to efficient service in a motor car.

The defeat of this relentless enemy can be accomplished by no other weapon known to motor car manufacture than the most scrupulous and properly applied standardization.

Once accomplished, it carries in its train two other splendid victories.

Wear, tear and repair are the evil offsprings of friction.

And when friction is reduced to a minimum, their capacity for discomfort, and danger, and damage is almost totally nullified.

At one and the same time, and from the same source, another splendid benefit is conferred upon the car.

Elimination of friction means extraordinary ease of operation.

It achieves that luxurious evenness which is supposed to be one of the chief characteristics in cars of the highest price; and the cardinal quality for which men are willing to pay that high price.

These extraordinary requisites—reduction of wear, tear and repair, and running qualities of velvety smoothness—are the distinguished characteristics of a frictionless car.

You have them in the Cadillac, because the Cadillac is the world's foremost exponent of anti-friction methods of measurements.

Advantages you may enjoy and Disadvantages you may escape

The presence or the absence of the qualities described herein—qualities traceable to properly applied standardization and the resulting correct alignment; qualities traceable to skillful design and advanced manufacturing methods and the results of scientific research and development, explain:—

Why the owner of one car has to crank and crank his engine to get it started while the Cadillac owner gets into his car, presses a button, disengages the clutch and his engine starts.

Why the owner of one car, even with a so-called "self-starter," can start the engine only some of the time while the Cadillac electric cranking device is fully as efficient and fully as dependable as every other part of the Cadillac car.

Why the owner of one car must get out—often in the rain and mud—open his lamps, fumble for matches, turn on and regulate the gas and light up while the Cadillac owner without delay or annoyance simply closes the switches and the electric lamps are lighted.

Why one car starts with a jerk and a lunge while the Cadillac can be started off with the smoothness of an ocean liner.

Why in one car about all the driver's strength is required to operate the clutch and brakes while with the Cadillac, slight foot pressure is all that is necessary.

Why in one car the change of gears is accompanied by a crash and a grind while with the Cadillac the change can be made so that it is scarcely perceptible.

Why one car is difficult to keep in the road while the Cadillac seems almost to steer itself.

Why in one car with a steering gear which has no provision for taking up wear, lost motion develops making steering uncertain and unsafe while in the Cadillac steering gear the adjustments provided are more adequate than will probably be required.

Why one car rides hard and stiff, the springs seem unyielding and the car is less comfortable to ride in over a paved street than is the Cadillac over an ordinary road.

Why one car may run quietly and smoothly when new but soon becomes noisy and shakes and rattles while the Cadillac often after years of service runs as smoothly as when new.

Why one car runs all right on level roads but when it comes to sand and hills it has not the power to make the pulls while the Cadillac has an abundance of power for all reasonable requirements and with its standardization, the correct alignment and the substantial construction, the maximum of that power is delivered at the rear wheels.

Why one car shows only 8 or 10 miles on a gallon of gasoline while the Cadillac averages 60 to 80 per cent. greater mileage.

Why one car after a few months begins to evidence a loss of power while Cadillacs frequently show an improvement.

Why in one car the engine overheats and the water boils while with Cadillac construction and the Cadillac cooling system the causes of overheating are practically eliminated.

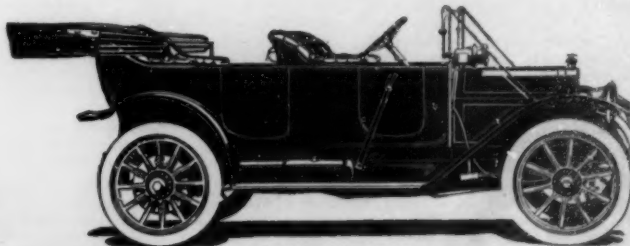
Why one car emits volumes of smoke and it becomes necessary to clean the engine and especially the spark plugs every few weeks, while the Cadillac with its efficient lubricating system and the accurate fit of the cylinders, pistons and rings emits no smoke at all and frequently runs for a year or more without even having a spark plug removed.

Why the oil consumption of one car is from two to four times that of the Cadillac.

Why the owner of one car must be continually tinkering with his car to keep it going while many Cadillac owners rarely open their tool kits.

Why one car after a few months' use depreciates in selling value to half its original cost or less while depreciation in the Cadillac is reduced to an absolute minimum.

So many "Whys" indeed, which evidence the pre-eminence of the Cadillac that we cannot here cite even a tenth part of them.



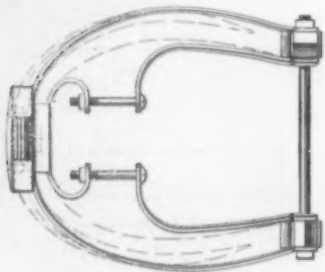
TOURING CAR \$1800

Other Models:—Four passenger Phaeton \$1800, four passenger Torpedo \$1900, two passenger Roadster \$1800, four passenger Coupe \$2250, seven passenger Limousine \$3250. All prices F. O. B. Detroit, including standard equipment.

Cadillac Motor Car Co.,

Detroit, Michigan

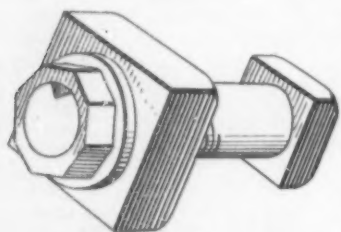
ADJUSTABLE ICE SHOE.—W. H. MORRIS (311 Russell Street) and H. HUDSON, Nashville, Tenn. The object here is to provide an adjustable ice shoe or creeper arranged for convenient attachment to a horseshoe and the hoof, and designed to prevent the animal from slipping when walking on icy or slippery roads. Further, to provide a shoe which may



ADJUSTABLE ICE SHOE.

be readily adjusted and securely placed in position on a horseshoe and a hoof. For the purpose use is made of auxiliary toe and heel calks mounted on caps fitting the ordinary toe and heel calks of the horseshoe, means for connecting the caps with each other within the opening of the horseshoe, and means for connecting the caps with each other around the hoof. An inverted plan view of the shoe or creeper is shown in the engraving.

NUT LOCK.—A. M. HEATH, Artesia, New Mexico. In this invention the improvement is in that class of nut locks in which the nut is locked on the bolt by means of some detachable device that is adapted to enter registering grooves or recesses in both bolt and nut. In Mr. Heath's invention, the locking device which is held and concealed in a cavity



NUT LOCK.

in the face of the nut, and a smaller nut is screwed into such recess and thus holds the locking device securely in place and also prevents it from accidental contact with exterior objects, while permitting its easy removal when it is desired to detach the main nut from the bolt. In the accompanying engraving is a perspective view of the bolt, nut, and locking means applied thereto.

Heating and Lighting.

TANK HEATER.—W. TINKER, Admooose, N. D. In the present patent the object of the inventor is to provide a simple, efficient and economical tank heater for use in preventing the freezing of water in tanks, which may be submerged in the tank, and which while submerged may be supplied with fuel.

LOCK FOR GAS COCKS.—J. J. COMER, Springfield Road, Queens, L. I., N. Y. The purpose of the present invention is the provision of a new and improved lock for gas cocks, which is very simple in construction, not liable easily to get out of order, and arranged to permit the owner of a building, loft, or other place, to lock the gas cock against opening or closing by unauthorized persons.

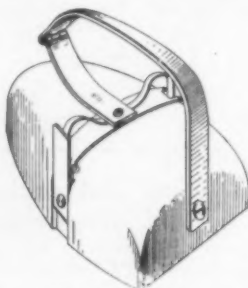
WATER GAGE.—F. E. GROSVOLD, care of A. H. Shoemaker, Eau Claire, Wis. Mr. Grosvold's invention relates generally to water gages and more particularly to an attachment for the expansion tank of hot water heating systems, whereby the height of the water in the tank may easily be ascertained. The object is to provide a gage which may be put to a variety of uses, but especially adapted for use on the expansion tank of hot water heating systems.

Household Utilities.

COMBINED CURTAIN AND SHADE HOLDER.—J. F. LEMIEUX, 4 Social Street, New Bedford, Mass. In the present patent the invention has reference to combined curtain and shade holders, and it has for its object the provision of one which combines a holder for curtains with one for shades, and which may be quickly secured in position, the holder having adjustable means for supporting two shade rollers and a curtain pole.

AUTOMATIC GAS AND DRAIN VALVE.—S. I. SHAND, 615 Hampton Street, Columbia, S. C. Provided in this invention is a mechanism for use with instantaneous water heaters to prevent injury to the coils by overheating when empty, or by freezing when full by means of which it will be impossible to apply heat until the coils are filled, or to shut off the water without drawing the coils.

COMBINED SMOOTHING AND GLAZING SAD IRON.—H. FLETCHER, care of A. E. Cox, Kitson Light Co., 470 Ann Street, Brisbane, Queensland, Australia. In this patent the invention is an improvement in sad irons of the character in which the body of the iron embodies a plurality of working faces, such, for example, as a smoothing face and a glaz-



COMBINED SMOOTHING AND GLAZING SAD IRON.

ing face, and a handle applicable to the iron to bring either of the faces in working position. When in this position the latches may be again moved within the slot, shown in the left side of the accompanying engraving, which is an illustration of a perspective view of a sad iron embodying Mr. Fletcher's invention, showing the handle locked in a position to bring the flat face of the iron in working relation.

TWIN WASTE FOR SOAPSTONE WASH-TUBS.—E. E. FLINT, 266 60th Street, Brooklyn, New York, N. Y. In this case use is made of a shallow waste basin, open at the top and provided with an outwardly extending marginal flange fitting against the under side of the wash tub bottom, the basin extending beyond both sides of the usual wastebut partition, so that outlets in the wastebut bottom open into the shallow basin which latter is connected at its flange by bolts with the flanges of the plug seats seated in the outlet openings, so that both the plug seats and the basin are fastened by the bolts to the bottom of the wash-tub.

Machines and Mechanical Devices.

SHOVEL POINT.—H. W. SNYDER, Hancock, Md. This invention relates to improved means of attaching shovel points in position, the principal object being to provide a device of this class which may be quickly and effectively held in position on a shovel and may also be easily removed therefrom when so desired.



SHOVEL POINT.

The device is intended primarily for use on steam shovels, the number thereof which may be used depending on the size and capacity of the shovel, the invention being directed to the supporting member and the point which is adapted for use on any steam shovel. The illustration herewith inserted shows a perspective view of the shovel point.

APPARATUS FOR PRODUCING TYPOGRAPHIC RECORD SHEETS.—Address: OTTO SACK, Brühl 2, Leipzig-Connewitz, Germany. This invention provides apparatus for producing perforated record sheets for use in typographic machines. According to the present invention these perforated records are produced by means of pneumatically actuated punches, the action of which is controlled by the type-keys of a typewriter, so that in copying a manuscript any errors made by the operator become apparent in the written copy, and the perforated record can be corrected accordingly.

SHEET FEED APPARATUS FOR TYPOGRAPHIC STAMPING MACHINES.—Address: OTTO SACK, Brühl 2, Leipzig-Connewitz, Germany. This device is for use in connection with stamping machines for impressing raised type and the like in sheets or plates to be used for printing purposes. The invention consists in mechanism for moving the metal sheet or plate for the spacing of the characters and for the length of the line. Means also provided for enabling the feed movements to be varied.

SAFETY CLUTCH FOR POWER PRESSES, PAPER CUTTERS, ETC.—L. H. BROWN, Hartford, Conn. Among the principal objects in view here are: to provide a clutch for power or drop presses wherein is employed a die which clutch is operable only by the employment of the two hands of the mechanic operating the press, thus insuring their removal from the danger zone of the press during the operation; and to provide operative means arranged to prevent the operation of the clutch by means of one hand singly.

MECHANICAL ADVERTISING SIGN.—J. SAMUELS, 218 Mercantile Place, Los Angeles, Cal. This invention comprehends a member representing a vehicle and made stationary but provided with wheels, mechanism for turning these wheels continuously, and a display

belt forming a background for the vehicle and moving continuously, this belt carrying various advertisements.

ADVERTISING DEVICE.—A. J. CLARK, Dayton, Tenn. This invention provides an advertising tag or card having means by which it may be attached to posts, trees and other parts, in such a manner that it may swing and sway in the wind, and to provide means whereby such advertising card or tag may be affixed at points beyond the reach of the hands, and, in fact, at points which may be deemed to be entirely inaccessible.

COMPENSATOR.—A. JOHNSON, 16 Dunham Place, Brooklyn, New York, N. Y. In this instance the invention has reference to a new and improved attachment for a bottle-capping machine whereby a support is provided for the bottle during the capping operation which will remain stationary under normal conditions, but which will yield when a bottle of abnormal length is being capped.

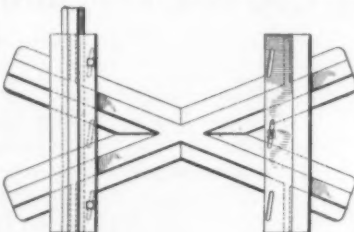
SAW SET.—J. SIMPSON, care of Evans Milling Co., Chicago, Ill. This invention has for its purpose the provision of a simple and inexpensive automatic device of the character specified especially designed for use with band saws, and wherein the setting mechanism may be adjusted for saws of various widths and for saws having teeth of different sizes.

Prime Movers and Their Accessories.

METHOD OF GOVERNING INTERNAL COMBUSTION ENGINES.—T. RIGBY, Station Hotel, Dumfries, Scotland. This invention relates to improvements in internal combustion engines and is mainly intended to be used in connection with those engines working on the single acting Otto cycle in which an extra charge of combustible gas, or air, or a mixture of both is admitted to the working cylinder in addition to the ordinary working charge drawn in during the suction stroke.

Railways and Their Accessories.

STANDARD METAL RAILROAD CROSS TIE.—C. T. KILGORE, Hot Springs, Ark. This invention is an improvement in cross ties and the tie is substantially X-shaped or cross shaped, consisting of arms connected at their inner ends and arranged in pairs as shown



METAL RAILROAD CROSS TIE.

in the plan view of the improvement in the accompanying illustration. The tie is spread over a considerable space for the material used, so that the tie is very stable, and cannot rock or twist. Neither is there any creeping of the tie with the rail. Rails of different sized bases may be used with the tie, since the slots permit considerable adjustment of plates.

EXTENSION CAR STEP.—W. G. WALTON, Fernday P. O., La. The object here is to provide steps which are nominally raised a distance from the ground and are disposed on stationary steps, the extension steps being lowered automatically by an opening of a gate on the car platform, the mechanism provided for so lowering the extension steps also serving to raise the extension steps automatically when the gate is moved into closed position.

Pertaining to Recreation.

TOP.—C. H. SAPPER, Newburgh, N. Y.—This invention relates to tops and it has for its object to provide one with a hollow member, in which an inner member is disposed, the inner member being journaled in bearings in the outer member and having surfaces which are exposed through openings in the outer member, the inner member being provided with wings, for retarding its rotation relatively to the outer member.

GAME.—J. W. HANLEY, 260 West 19th Street, New York, N. Y. This invention provides a game chart to receive counters or objects, such as playing cards, permitting various permutations and combinations of the counters, the chart preferably being provided with divisions respectively adapted to receive individual counters, and certain of these divisions bearing indicia which, observed in connection with the particular card thereupon, at each observation, serve to determine the result of the play.

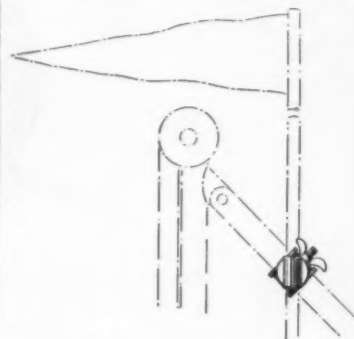
GAME APPARATUS.—V. M. VACEK, Vienna, Austria, care of JOHN V. VACEK, 318 North 24th Street, South Omaha, Neb. For the purpose of this game, use is made of two equal sets of game pieces, adapted to be moved over a game board divided into ninety-nine squares, each set of game pieces representing a queen, a general, two foris, light and heavy infantry, light and heavy cavalry, artillery, rapid fire guns, an aerial vessel or aviator, scouts, and a bridge.

PUZZLE.—P. G. FERNBY, 3 Winter Street,

Sanford, Maine. In this puzzle use is made of a ring and sectional figure having a body with integral outstretched arms and spread legs rigidly connected with each other and pivoted to the lower end of the body, the inside diameter of the ring being larger than the width of the said body and less than the width of the said legs, and the outside diameter of the ring being less than the distance between the spread arms.

Pertaining to Vehicles.

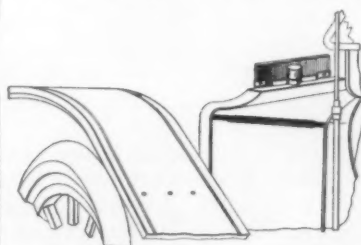
SUPPORTING DEVICE.—M. J. SHIMER, care of W. SHIMER SON & CO., Freemansburg, Pa. The intention in this case is to provide a device more especially designed for use on



SUPPORTING DEVICE.

automobiles and other vehicles, and arranged to permit of securely fastening the pole for a flag, pennant or other article to a suitable support such as a wind shield or other part of the vehicle. A side elevation of the supporting device as applied to the wind shield of an automobile for supporting the flag is pictured in the engraving. The device is simple and durable in construction and can be readily applied, and the parts are not liable to get out of order or lost owing to the ring holding the members together.

HOLDER FOR REGISTRATION NUMBERS.—O. M. HEROLD, 60 Leamy Street, Gardner, Worcester, Mass. Mr. Herold's invention is a holder for registration numbers of automobiles, motor cycles, and vehicles in general, and it comprises a clamp designed to be attached to the radiator base or any other suitable support on the vehicle, and having fastening devices by means of which the num-



HOLDER FOR REGISTRATION NUMBERS.

ber plate is secured to the clamp and held thereto in position to be readily seen when in use. The engraving inserted herewith presents a view of the front of an automobile showing the holders in place. It is obvious that the invention may be used for signs, placards or any other thing of the sort that it is desired to exhibit in stores, show-windows or other public places.

STARTING DEVICE.—C. T. LEACH and G. W. CANFIELD, Yale, Okla. In this patent the starting shaft, which has a starting lever, and the engine shaft, have operative connections of novel design, including a clutch, and special forms of bearings are provided for the shaft and appurtenances, with the idea of providing a simple and practical construction of starting device adapted especially to automobile engines.

RESILIENT WHEEL.—H. W. BROOKS and S. F. KRUPP, care of Continental Gin Co., Memphis, Tenn. The aim in this improvement is to provide a wheel in which the hub and the spokes, together with the rim, form an integral structure, the tire being resiliently positioned between opposite sides of the wheel whereby the tire may move relatively to the rest of the device as it is drawn over the roadway.

Designs.

DESIGN FOR A WARDROBE DRESSER.—R. A. JENNINGS, P. O. Box 6, Greensboro, N. C. In this ornamental design for a wardrobe dresser, the article of furniture is of plain outline and simple decoration, which results in a very attractive production. The design may be praised for variety of features, of which the top, the main compartment and small drawers are impressive and entirely original.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

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361 BROADWAY, NEW YORK
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Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AERONAUTICS

FLYING ALL WINTER—Greatest Money Maker in the World. We make you a Pilot in 10 lessons—\$250—We stand all breakage. For further particulars address Stevens & Beatty, 262 9th Ave., N. Y.

AUTOMOBILES AND MOTORCYCLES

AUTOMOBILES, \$50.00 up; **MOTORCYCLES**, \$30.00 up; guaranteed for one year, shipped freight prepaid. Largest list and lowest prices in the world. King Automobile Broker, Dept. S. A., 315 West 125th Street, New York City.

BUSINESS OPPORTUNITIES

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from \$1.00 to \$100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

INSTRUCTION

LEARN JEWELERS' ENGRAVING.—Taught thoroughly by mail. Beginners learn better engraving than in six months than in years of rigid apprenticeship. Cat's free. Engraving school, Dep. 69 Face Bldg., Chicago.

WANTED

WANTED—A man or woman to act as our information reporter. All or spare time. No experience necessary. \$50 to \$300 per month. Nothing to sell. Send stamp for particulars. Sales Association, 655 Association Bldg., Indianapolis, Indiana.

PATENT WANTED. Owners of processes for extraction of aluminum from kaolin; address particulars and royalty expected, W. C. Marshall, 308 Union Oil Building, Los Angeles, California.

MISCELLANEOUS

IMMORTALITY CERTAIN. Only 15 cts. for Swedenborg's great work of 400 pages on the life after death, furnished postpaid. Stamps taken. Pastor Landenberg, Windsor Place, St. Louis, Mo.

MONEY-MAKING FARMS. Throughout seventeen states. Tell us what you want and we will tell you where it is. Big illustrated catalogue No. 35 free. We pay buyers' fares. E. A. Strout, Station 15, 47 West 54th Street, New York City.

LEARN TO COLLECT MONEY.—We teach you a sure, simple system. Income \$1000 to \$5000 a year. Quick results. No capital required. Book sent free. "Successful Collecting," Nat. Collect's School, 40 Park Pl., Newark, O.

INQUIRY COLUMN

Inquiry No. 9247.—Wanted, to buy a Paracetic aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256.—Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257.—Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 2959.—Wanted to buy a machine for removing the coating of a filament.

Inquiry No. 9260.—Wanted addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games.

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263.—Wanted, name and address of manufacturer of pantalon stretchers with clamps, which is capable of being folded up.

PROPOSALS

CONTRACTORS

Subway Bids Opened
March 22, 1912

for the construction of Section 2-A of the Lexington Avenue Rapid Transit Railroad of New York City. 530 feet of four track subway, between Walker Street and a point 50 feet north of the center line of Howard Street, embracing the Canal Street station and the underlying portion of the Canal Street subway.

Write or call concerning forms of contracts, plans and specifications.

PUBLIC SERVICE COMMISSION
for the FIRST DISTRICT

154 Nassau Street New York City

Notes for Inventors

Sectional Electric Fixtures.—Much delay in securing electrical fixtures is obviated by the introduction of a new idea in their manufacture. The fixtures are made on the sectional plan and patrons desiring to secure a fixture, buy the parts necessary for the number of lights desired and assemble them to suit their purposes. Thus with 86 standard parts it is possible to make up nearly two thousand fixtures of different shape and size.

A Novel Electrical Heater.—Among the newest application of electricity to heating and cooking, is the "quartzalite" system which was recently shown at the London Electrical Exhibition. The heating element of this appliance consists of spiral wires of special composition inclosed in a quartz tube. When the current is switched on the wires are raised to a bright red heat. The quartz cannot become melted except by the action of the electric furnace. The cost of maintenance is said to be very low and the efficiency high.

A Vacuum Bottle Suggestion.—Frequently there are found in old and expired patents ideas and constructions capable of embodiment in articles of recent commercial development. Our attention has been attracted to a patent issued June 14th, 1864, for a bottle or canteen having a body portion divided into two compartments in which different liquids may be placed. The independent discharge orifices from these two chambers or compartments open through a flat top to which is fitted a neck or pouring nozzle mounted so it may be turned to bring its discharge channel into communication with the outlet from one or the other of the chambers to dispense liquid therefrom, and when the nozzle is turned to an intermediate position it forms a valve or closure to stop the discharge from both chambers. In adapting this idea to vacuum bottles, the number of chambers may be varied as well as the special application of the rotating neck or nozzle and doubtless interesting inventive problems will be presented to one seeking the practical production in a vacuum bottle of the duplex chambers with the discharge nozzle common to both.

A Gradually Disappearing Moving Picture.—In patent No. 1,011,564 Frank von Briesen of New York city presents a moving picture film having a series of pictures representing consecutive phases as is usual with such films, but he makes a last print of the series and a plurality of reproductions of the last print directly succeeding the same, the reproductions being successively printed in darker shades to gradually merge into a black field.

A Revolving Tooth Brush.—Joseph Gaynor of New York city has patented No. 1,007,090 a tooth brush which has a cylindrical brush mounted on a shaft journaled in bearings and having a toothed pinion which is meshed by two toothed bars projecting inwardly from handles like those of a pair of pliers. A spring opens the handles and as they are pressed together their toothed bars meshing with the pinion turn the shaft and thus rotate the tooth brush.

Meat Preserving Process.—For preserving raw meat, Otto L. Ahrens, of Hamburg, Germany, has patented, (No. 1,007,908) a process in which he dips the meat repeatedly into fat heated to about 200 deg. Cent., and allows the expelled water to drain off together with the fat each time the meat is lifted out until the meat has been completely expelled, the meat being then placed in a vessel, closed air tight, and filled with hot fat and the fat being driven out by a neutral gas.

A Novel Oil Transporting Method.—Patent No. 1,007,788 granted to Edward N. Mills, of Oakland, California, discloses a method of transporting oil in a pipe. It consists in mixing with the oil, minute bubbles of air to form a foam and applies pressure other than that of the air to move the oil through the pipe.

A Voice Typewriter.—A patent has been granted to Arthur C. Ferguson, of Brooklyn, N. Y. (No. 999,975) for a method of printing by sound. The apparatus

"I Want It In Puritan Serge"

Know Your Style
Pick Your Cloth

For clothes that will "stand up" against the wear and tear of busy days—

Get a suit made of our **PURITAN SERGE**. 'Twill be a suit you'll hate to part with, even after it has served its time.

Ready-to-wear or custom-made—the choice is up to you. But if you'd be sure of its looks and its wear—specify **PURITAN SERGE** in any case.

Resists wrinkles—"comes back" after every pressing—does you credit every time you put it on.

PURITAN SERGE is a strictly pure all wool cloth of fourteen-ounce weight for spring and summer wear; a distinctive blue, noticeably rich in tone; width, 58-60 inches—London shruak.

Specify at your tailor's or clothier's—"PURITAN SERGE." If they cannot supply you, send their names to us, together with your money order or check for the desired quantity of **PURITAN SERGE** at \$3.00 the yard (3½ yards to the suit), and we will see that you are supplied through regular channels as we do not sell at retail.

Remember to "Order the Cloth as well as the Clothes," when you buy. **PURITAN SERGE** is extensively used by makers of high-grade, ready-to-wear clothing for men.

Reg. Name Stamped on the Cloth

PURITAN SERGE

A Thoroughbred Serge
For the Man who Cares

American Woolen Company

Selling Agency: American Woolen Co. of New York
American Woolen Building
18th-19th Streets on 4th Avenue, New York

Wm. M. Wood, President.

TEXACO MOTOR OIL

YOU, the car owner, need no longer number cylinder troubles among your motor cares.

Pitted cylinder walls and valves, weak compression, faulty ignition, can almost invariably be traced to an inferior cylinder oil.

The perfect cylinder oil contains no carbon impurities. Its lubricating qualities have not been impaired in order to eliminate carbon. It shows a zero cold test.

Texaco Motor Oil meets these requirements. The most careful working tests have shown none of the troublesome carbon deposits so common with motor oils. It burns absolutely clean. It has sufficient body to lubricate perfectly. Cylinders never "dry out," never become scarred or pitted. It has a cold test of zero and thereby eliminates all of the lubrication troubles usually caused by cold weather.

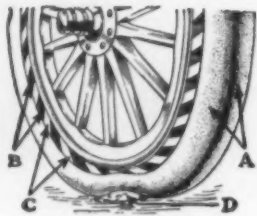
These are strong statements. You may feel skeptical. The best proof of their truth is in the use of the oil itself. Try a can. Sold in 1 and 5 gallon cans at garages and supply shops. For instructive booklet, "About Motor Lubrication," address Dept. B, 6 Washington St., New York City.

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The Utility Tire for Light Delivery Cars

Owners of Light Delivery Cars are saving thousands of dollars by equipping their machines with Motz Cushion Tires. For these wonderful tires not only give the utmost in service, without repair cost, but possess as much resiliency as the properly inflated pneumatic tires. They act as a buffer between the car and the road and render harmless many a shock, bump and jolt which would soon ruin any commercial car. And the Motz Cushion Tire can be applied without delay—without removing wheels.



A—in the picture shows double treads.
B—shows undercut sides.
C—shows slantwise bridges.
D—shows how perfectly the tire absorbs shocks when car passes over an obstacle (from actual photographs).

MOTZ Cushion Tires

Note how we attain such surprising resiliency. See the **double treads**, the **slantwise bridges**, the **undercut sides**. These patented features make a commercial car ride as easy as a pleasure car, and **do away with skidding**, too!

Put Motz Cushion Tires on your commercial car and you'll just about **double** its period of service and reduce upkeep expense 75 per cent.

Motz Solid Tires

For heavy duty Trucks, use Motz Solid Tires on demountable rims. They are absolutely unbeatable.

All Are Quick-Detachable

All Motz Tires are **quick-detachable**. They fit any standard clincher, universal quick-detachable or demountable rim. You don't have to take off wheels or lose time in replacing these tires. It's child's play, compared to the old-fashioned way of applying Truck Tires.

Write for Further Facts

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Please write us and ask for Booklet 93.

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Factories and Executive Offices, Akron, Ohio

BRANCHES: New York, 1737 Broadway; Chicago, 2023 Michigan Ave.; Detroit, 999 Woodward Ave.; Kansas City, 409 E. 15th St.

(181)

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claims to be nothing more or less than an apparatus into which one can talk and from which one can take a printed record of what has been talked, in other words, a voice typewriter. How successful the apparatus is in actual practice it is impossible to determine from a mere inspection of the patent copy. In the preamble to the specification the inventor states that "the uttering of a word produces a sound varying in its vibrations from other sounds used, and thus being capable of actuating the transmitter to an extent different from other sounds, and thus print through an interposed member a character corresponding to the sound produced before a transmitter." The invention is based upon the principal that as the sound waves of every sound produced at a diaphragm differ from the waves of every other sound, so the vibrations of the diaphragm differ in amplitude, and therefore the effect on the selective intermediary is correspondingly varied, so that the required printing member for each letter or word, that is, sound or combination of sounds, is controlled or set into operation simply by the peculiar effect, which is produced on the intermediary by the particular vibrations of the diaphragm by the particular word or sound directed thereto.

A New Form of Police Telephone.—As a means of cutting down the number of policemen required for patrol duty, a new telephone system has been installed in the outlying districts of Berlin which is said to be remarkable for compactness and efficiency. There are outlets at frequent and close intervals which are so tiny as to be in no wise obtrusive. They are little circular boxes mounted on walls or convenient posts. Members of the police force in uniform and the secret service attaches of the force are supplied with transmitter and microphone of a size which permits of their being carried in a vestpocket, and the connection can be made in an instant and the officials are at once in touch with their superiors. The system is a success in every particular and the installation will be extended.

Protects Submerged Piles.—Thomas Nixon of Santa Barbara, California, protects submerged piles by keeping them clean with chains hung by their upper ends to the piles so they can swing back and forth and operate by a scraping action. The invention is protected by patent No. 1,008,669.

A Sulphur Mining Process.—Herman Frasch of New York City, assignor to The Frasch Sulphur Process Co., has patented (No. 1,008,319) a process of mining by liquification especially applicable to sulphur deposits, in which an artificial wall of sand is formed in the deposit about the well hole, such wall retaining the liquifying fluid or hot water, the latter operating to melt the substance being mined and the solution being subsequently separated in suitable manner.

Legal Notes

Delays are Dangerous.—The importance of a prompt filing of applications for patents, should not be underestimated. Decisions repeatedly emphasize the dangers of lack of diligence. In the case of *Floyd v. Roling*, 152 O. G., 230, the Court of Appeals said that where Floyd, who was the first to conceive the invention in issue but the last to reduce it to practice, was lacking in diligence before and at the time Roling entered the field, that this lack of diligence could not be cured by his activity after that time since he was the last to reach the Patent Office. Many times the one who reaches the Patent Office first prevails because of such fact and the inventor should not only proceed with diligence to complete his invention, but should employ equal diligence in securing an actual filing of his application in the Patent Office.

Dieckmann v. Brune.—The Court of Appeals of the District of Columbia in the interference appeal of *Dieckmann v. Brune* has reversed the decision of the Commissioner of Patents, the case being somewhat unique since all of the decisions of the Patent Office tribunals agreed and all were reversed by the Court which in its

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decision says: "The tribunals of the Patent Office concurred in awarding priority to Brune, and Dieckmann has appealed from the final decision of the Commissioner. In reporting the case the *Patent Office Gazette* says: "B conceived the invention in issue in 1903, built a machine in accordance therewith which was kept in a room to which only he and a few employees had access until an application for patent on the machine was filed on January 31st, 1906. Elbows made on the machine were in the meantime placed on the market. Held that by concealment of the invention B lost his rights in favor of D, who conceived the invention of some of the counts of the issue in 1893 and that of the others in 1901 and filed his application on January 18th, 1906."

Foreign Trade - mark Registration.

Some foreign countries, notably in South America, register a foreign trade-mark to the first applicant regardless of whether he is a manufacturer, producer, or other proprietor of the particular goods to which the mark is applied and the registrant then proceeds to levy tribute on the *bona fide* owner of the mark and can prevent importation of the goods without the consent of the registrant of the mark. For this reason it is important for manufacturers marketing under a trade-mark to secure registration before the value of the mark is realized by the residents of such country and certainly before exporting abroad since the importing agent may himself register the mark and thereafter dictate his own terms. It has been said that some of the United States manufacturers of fire arms, hose supporters and pencils are among those who have suffered from piracy of their marks.

Marking a Device Patented.—We are all accustomed to see a patented article marked "Patented" with the date of the patent. It is doubtful, however, whether one in a hundred, or in five-hundred who notices the mark realizes its importance to the patentee. The statute on the subject makes it the duty of all patentees or those holding under or making the patented article for them, to apply the mark "Patented," together with the day and year the patent was granted, and the same statute provides as a penalty for not marking, that "in any suit for infringement by the party failing to so mark, no damages shall be recovered by the plaintiff, except on proof that the defendant was duly notified of the infringement and continued, after such notice to make, use, or vend the article so patented."

Similarity of Mark Tending to Deceive the Public.—In *ex parte*, Seabury & Johnson, O. G., 173, page 865, Assistant Commissioner Tennant in affirming the Trade-Mark Examiner's decision refusing to register the trade-mark, discusses similarity of mark, as follows: "The applicant points out certain differences between the marks, and while such differences exist it is believed that, taken as a whole, the marks so nearly resemble each other that confusion would be likely to arise from their simultaneous use when applied to goods of the same descriptive properties. It is true that if the marks were put side by side their differences could be easily discovered; but this fact is not sufficient to determine that there is no such similarity as to be likely to cause confusion in trade. The true test is whether a purchaser looking at an article offered to him would naturally be led, from the mark impressed upon it, to suppose it to be a production of a rival manufacturer with whose mark he is familiar."

A Decision on Process Patents.—In the case of Model Bottling Machine Co. v. Anheuser-Busch Brewing Association, Circuit Court of Appeals for the Eighth Circuit, it was held that a patent for a process may be anticipated by a prior patent for a machine which fully discloses such process; also, that an application for patent for a process cannot be considered for the purposes of the question of anticipation, a continuation of a prior application for a patent for a machine for carrying out such process, which although disclosing the process did not claim it.

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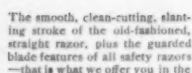
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sioners of Laramie and Albany counties, until now the crossing of the Rocky Mountains by this route offers practically no resistance to the automobilist. By the opening of the auto season of 1912 Wyoming will have a transcontinental route across the Rocky Mountains that will, without doubt, be the route of the least mileage and the least resistance of any route crossing the Rocky Mountains. The other State highway designated by the Legislature is known as "The Yellowstone Highway." It extends in a northwesterly direction from the city of Cheyenne, through the towns of Wheatland, Douglas, Casper, Thermopola, Basin, Cody and thence to the eastern portal of the park. This highway is 542 miles in length, has but little grade to contend with and is at present travelable by automobile. The State Engineer is at present at work in making surveys for its possible betterment, eliminating curvature, etc. There is no trouble for the auto tourist to travel it at any time. In the next few years the State hopes to make it a highway not to be exceeded by any highway in the eastern States. Nearly all of the counties in the State have their Good Roads Association, with large membership and enthusiastic workers. At present it is planned to mold these into a State good roads organization. The State has about 10,600 miles of public roads. There are 416 miles of government roads in the Yellowstone National Park and the adjacent National forests. The roads of the State are generally good, since the rainfall is light, the soil porous and the traffic not very heavy.

NEW BOOKS, ETC.

AERIAL NAVIGATION. By Albert Francis Zahm, A.M., M.E., Ph.D. 485 pp.; illustrated. New York: D. Appleton & Co., 1911.

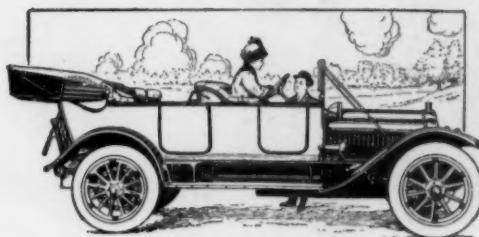
It would not be too much to say that Dr. Zahm has given us the best popular book on the airship and the aeroplane. No less could be expected of a man who is probably the foremost authority on aerodynamics in this country. A work such as this is to be particularly welcomed at a time when the market is flooded with popular books on aerial navigation, written for the most part by men who know little of the subject, except what they have read in popular magazines and newspapers, and who are trying to turn an honest penny by writing books which are supposed to meet the popular demand for information. Our only regret is that Dr. Zahm's book should not have appeared earlier. Dr. Zahm has treated his subject historically, but has carefully excluded, as he tells us in his preface, those experiments which, however picturesque or clever, constituted no advance in the art or led to no useful result. The result is a very compact presentation of what is really historically valuable. The book is divided into four parts: the first deals with the growth of aerostation, the second with the growth of aviation, the third with aeronautical meteorology, and the fourth is composed of appendices. Though frankly intended for popular reading, Dr. Zahm's book gives every evidence of scholarly research. Here will be found clearly laid down the actual contributions made in the development of the dirigible by Haeckel, Woelfert, Santos-Dumont, Col. Renard, the Lebaudys, and Zeppelin, and the part played by Henson, Ader, Stringfellow, Chanute, Langley, Lilienthal, Herrig, Wright, Montgomery, Santos-Dumont, Farman, Curtiss, Biérot, and the rest in the development of the aeroplane. Unlike most of the popular books of the day, Dr. Zahm's contribution is strictly up-to-date, for it brings the development of the aeroplane and the airship down to the end of 1910.

THE SECOND BOYS' BOOK OF MODEL AEROPLANES. By Francis A. Collins. New York: The Century Company, 1911. 8vo.; 262 pp. Illustrated. Price, \$1.20 net.

The length of flight of the model aeroplane is now ten times that of the earlier models, and much of this improvement is directly traceable to boy students and workers. In this delightful volume are pictured more than fifty different types, resembling all sorts of animate and inanimate objects from a mosquito to a rat-trap. Some of them show great ingenuity, and are capable of remarkable things. As to motive power, a flight of half a mile is possible by means of twisted strands of rubber, while with the miniature gasoline motor distances of a mile have been traversed in single flights. Instructions for making and flying the models accompany the plates; there are practical rules for conducting races and tests, and the draft of a constitution and by-laws for a model aeroplane club. A catechism on aeronautical problems and practice is given, with a glossary of aeronautical terms. It is a book to warm the heart of the boy mechanically inclined.

RAILWAY SHOP KINKS. New York: Railway Age Gazette, 1911. 4to.; 290 pp.; illustrated. \$2.00.

The publication of "Railway Shop Kinks" makes available to readers at large not only the rules, expedients and devices discussed by the Executive Committee of the International Railway General Foremen's Association, but also a mass of practical material submitted in competition to the *Railway Age Gazette* and published by it from time to time in its shop section. The "kinks" cover the machine shop, erecting shop, boiler shop, smithy, brass foundry, tin and copper shop, engine house, car department, and many other departments and purposes. A full index places any desired kink at the immediate command of the needy one. The hints and devices are of the helpful, time-saving and labor-saving nature that are most welcome wherever wood and metal are shaped into the inventions of civilization.



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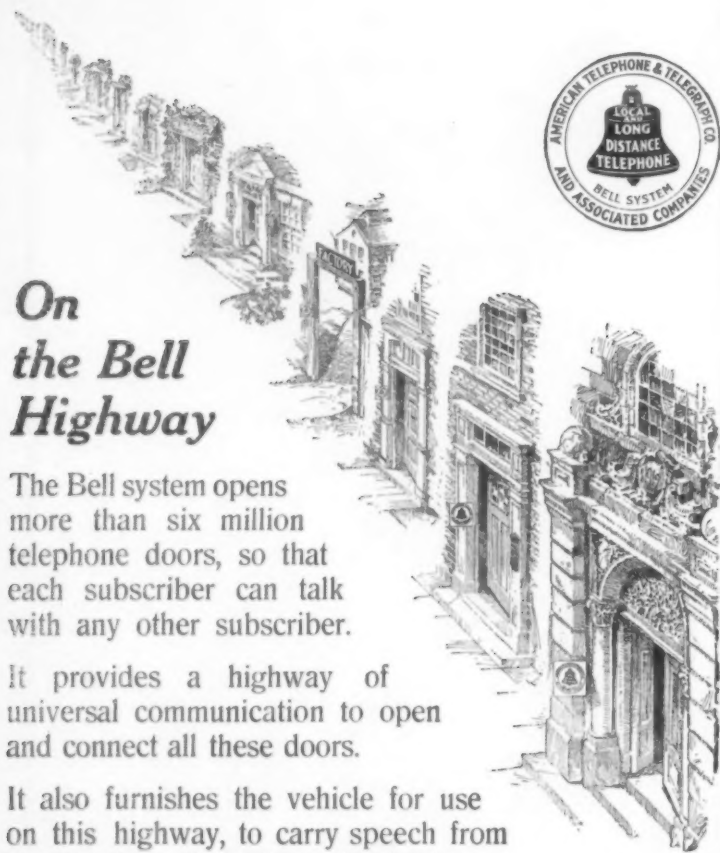
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SCIENCE IN THE IDEAL HOME

The April Magazine Number of the Scientific American
Issue of April 13, 1912

Scientific management, with its close attention to important details, is not confined to the shops or the industries, but is applicable to all lines of human activity. Last year, Frank B. Gilbreth, the well known Efficiency Engineer, published a book on "Motion Study," and to illustrate his argument he showed how, by attention to seemingly unimportant details, and the elimination of wasted effort in awkward and useless motions, he had actually increased the efficiency of brick-layers many-fold. Although this book made a sensation and attracted widespread attention, its value was by no means fully realized because many readers took it for granted that it pertained solely to the building trades. But the principles that Mr. Gilbreth outlined have a very broad application, as evidence of which he is going to explain to the readers of the Scientific American how Motion Study may be applied in the home to relieve the drudgery of housework. The article is not to be made up of broad generalizations, but will be fully illustrated with specific examples of actual conditions as they have been studied by Mr. Gilbreth in his own and other homes.

One of the most serious problems that the home presents to the engineer, particularly the detached villa or country house, is the sanitary disposal of sewage. The problem is more complicated than that of the municipality, but much deep study has been devoted to the subject, and excellent methods have now been developed for the purification of the sewage and the destruction of bacteria. This subject will be treated very thoroughly by Dr. Jacolyn Van Vliet Manning.

There is an experiment station in Colonia, New Jersey, where domestic engineering is being studied scientifically. Here all manner of labor-saving devices are subject to practical and impartial tests. It is the only station of its kind in the world. Mary Pattison who is a pupil of Frederick W. Taylor and Harrington Emerson the well-known efficiency engineers, is going to tell of her interesting work there in the April Magazine Number.

In addition to these articles the number will contain the usual variety of material, including an article by William Atherton DuPuy on the Woman Inventor.

Building Good Roads by Auto Power

(Concluded from page 234.)

half the men it took for one outfit with horses. It cost from \$2.50 to \$3.00 a day in gasoline, oil, etc., to run the truck. Counting depreciation, interest, and repairs the cost was not over \$5.00 a day. The driver's wage was about \$3.00 a day. This would make a total cost of not over \$8.00 a day, against \$12.00 to \$16.00 a day for teams to do one-half the work done by the truck.

The truck was used also for dragging roads with a heavy split log drag. It has covered better than fifty miles of road with the drag in three days time of ten hours each. Pulling two lighter drags it has finished twenty miles and better in a single day. The plan in this township is to use a headlight on the truck. When the roads get ready after a rain or in the spring, the machine goes over the whole township, running night and day till the job is done. With this scheme the townsmen are able to drag more roads than half a dozen men and teams could handle, and they get the road done at the right time. With the special wheels the roads are dry enough for the machine, when they are dry enough to drag.

The Hooper Township trustees have since found that the truck could have handled the work of at least two townships with almost equal ease, and at the same time have lessened the expense considerably. However, they find use for the truck and make it manage to earn its gasoline all the year round, grading, hauling bridge, culvert, and other road material and doing other work for the township. Besides, when it is not in use, it doesn't cost anything for feed or care.

At first there was a good deal of opposition to the purchase of the truck by the citizens of the township, and a lot of complaint about it after it was bought. There are a few taxpayers there who still insist that "that contraption will bankrupt the township." But the majority of citizens of Hooper Township admit that the truck is saving them money. However, there are still some men there who complain at the first cost, which in this case was \$2,500. Other townships are seriously considering the purchase of a similar truck. In several townships the question, "to buy or not to buy" a motor truck was the chief issue in the campaign last fall, and will be again. In the mean time Hooper Township has better dirt roads than ever before and at less cost. For that locality, the motor truck is solving the road problem.

Out in Boise, Idaho, the county commissioners have bought a truck like the one in use in Nebraska. Mr. E. A. Crawford, chairman of the Board of Commissioners, says that they use their truck chiefly for hauling crushed rock for road construction. On a three-ton truck, pulling two trailers, they haul eight-ton loads up grades of eight per cent or better. They have tried the truck out at other work also, and found it satisfactory, but have enough hauling to do to keep it busy. With them the truck does the work of two to four teams and drivers, and does it at about half the cost of team hauling.

A firm in Jefferson, Iowa, has a contract with the supervisors of two counties for supplying them with drain tile for culvert and road drainage work. It takes a lot of tile there too, but the firm is able to cover the whole two counties with the motor truck, and keep the road gangs supplied with tile. Incidentally the firm is making money for prices current for horse haulage are charged. The counties could save a good sum by owning their own truck.

Another truck engaged in road and bridge building is one owned by a lumber company of Grinnell, Iowa. This truck is busy most of the time hauling sand, rock and cement to bridge contracts. This past season it hauled a total of over 4,000 tons an average distance of over four miles. Some of these bridges were ten to twelve miles from the source of supply. They hauled right through the hottest weather, too, when horses couldn't work much because of the heat.

A crushed stone company, of Cedar Rapids, Iowa, hauls crushed limestone for paving foundation, macadam, and other road and street work, and also uses its truck to pull trailers, hauling as high as ten tons on the truck and two trailers at one load.

On the roads about Jamestown, California, a motor truck is used to counteract the wearing and rutting effect of the automobiles. It has been found that an



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In St. Louis a paving company is using a three-ton truck fitted with a special body for hauling hot asphalt for paving construction and repair work. The machine loads up the hot asphalt at the central plant, and delivers it at any distance up to fifteen or twenty miles still hot and ready to apply.

This is one of the good points of the motor truck for road work. A body fitted for hauling any sort of material can be supplied by most makers of trucks. Dump bodies for stone, sand, crushed rock, etc., lumber racks for hauling bridge material or plain platforms for grading work can be had according to the need. A dump truck and a couple of trailers can haul dirt from cuts to distant fills as fast as six or seven teams, where steam shovels or similar methods of loading are used. There is almost no end to the uses to which such a machine may be put for furthering the cause of good roads. It has been used for running the cement mixer on jobs of concrete construction for culverts and bridges. One truck at least is fitted with a drive pulley which enables it to do all sorts of work on the belt, such as running a small stone crusher, a cement mixer or a pile driver.

The use of the motor truck in road building fits in particularly well with the plan of centralization. With the truck one man, or one set of men can handle a comparatively large territory in grading, in permanent road construction, in bridge and road drainage work, in road dragging, or in road repairing. The cost, where there is work enough for the truck to warrant the initial expense, is far less than where team power is used, both because of lessened labor and greater speed. The effectiveness of the road force is greatly increased and the quality of the roads is bettered by the use of the truck.

Of course, to obtain all these results the truck used must be fitted for the job. It does not need to be very speedy nor very heavy, but it must have a powerful motor, and the right kind of wheels for traction. Moreover, the operator must be a man of some skill and judgment. It may cost a little more to hire such a man, but the better road that will result from his work will more than pay for the extra cost in his wage. Where bought for the purpose, and used with reasonable intelligence and skill, the motor truck is proving a remarkably efficient "good roads agent."

The Coleman du Pont Highway

(Concluded from page 245.)

It is the author's belief that road building in the United States is in a very undeveloped state, and that within five or ten years we will find some mixture of tar or asphalt that can be mixed in a small percentage with the natural ground (sand, loam, clay or other material) and that in this way we shall get a water-proof and dust-proof road at a small cost.

Records, too, will be kept to see if the income from the extra width will in time pay an amount that will, first, maintain the road; second, pay interest on cost of the road; third, pay the cost of the road, and after this be a source of income that would pay all county or city taxes. The writer's opinion is that it will, and, if so, let the towns or counties or the Nation take enough ground, when building a new road, to ultimately make the road pay for itself, and allow the people who want to use the land to have it on 999 years lease, with certain conditions, at 4 per cent, the value of the land for purpose of paying rent to be adjusted every five years.

If the National highways could be built on this plan, it would only mean a temporary outlay of money by the Government, which would in a few years provide a source of income equal to that afforded by the tariff. This Government is necessarily becoming more and more expensive each year; therefore, the question of providing greater income will soon be an important one. By the plan suggested the money could be raised without injuring the interests of the users of the land. The



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Government, State or federal, as the case might be, would get what it was entitled to from the people who properly should pay it, and the people would obtain land on a 4 per cent basis. Finally, the speculative value of the real estate near the road should accrue to the Government, to whom it would properly belong.

Brucker's Transatlantic Airship Expedition

(Concluded from page 245.)

control, it may be very helpful. Greater stability of flight has been provided by increasing the size of the horizontal fins in the rear, which also exert greater leverage at the end of a longer hull. To take the best possible advantage of the powerful lifting and depressing action of increased speed, new and highly efficient devices have been provided for steering in a vertical plane, by combining the front horizontal rudder of the small Parsevals, with the air ballonets in both ends of the larger Parsevals, which, under the action of a distributing valve, shift the gas lift from front to rear or vice versa, in the well-known way. Two sets of horizontal rudders are carried on both sides on the reinforced front end of the gas bag. The control of unruly gas lift by these devices is instantaneous and powerful.

The old sluggish shifting weight has been discarded as a means of vertical steering. In addition to the two maneuvering air ballonets, the ballonet for compensating gas losses in the center has been preserved, and all three ballonets have now a capacity sufficient to compensate a gas loss of 4,000 cubic meters. Even if the gas loss should ever become so great that the outer ballonets are practically out of action as controlling devices (remaining distended), the horizontal rudders still provide a strong control of variable gas lift. The total capacity of the envelope has been increased by nearly 1,000 cubic meters, furnishing a reserve for emergencies.

The motors are the same six-cylinder N. A. G. motors, each of 110 horse-power, that have never broken down on the long passenger trips of the "Parseval III." and "Parseval VI." when they were subject to great strains in counteracting the irregular air conditions over firm ground. Over the placid tropical sea the motors of the "Suchard" will have much easier work. Still, nothing is expected from them by the conservative advisers of Mr. Brucker, like the endurance of a steamer's engines (in spite of their working alternately) for it has been decided to stop the propellers during the night and, drifting with the trade wind, to give the crew a good rest as well. Duplicate parts are carried and the best facilities for repairing provided aboard. The whole engine room is now so simply arranged that one engineer at a time can run the whole plant. There is an auxiliary transmission shaft, from which the ballonet-blower, the blowers for the radiators, and the winch for scooping ballast, are driven. The shaft of the water screw is at the bottom of the engine room and can be driven by both motors. The blower for the ballonets, solidly built and of great capacity, is also driven by a small "donkey" motor, and can be conveniently operated by hand in emergencies.

Comfortable bunks for the crew are below deck; gasoline is carried in fire-proof tanks along the bottom of the boat. With a partial "deck" with staircases and doors, this spacious boat looks exactly like a small river steamer, and it is difficult to imagine it a thousand feet above the sea.

The ship is now being rapidly completed for trial trips in Germany and early shipment to the Cape Verde Islands. With an airship that is now a regular Parseval of the approved and tried type, and capable of making safe and extended trial flights even under the difficult air conditions of the temperate zone, complete success may now be reasonably expected. Capt. Joerdens, its commander, for long a noted pilot of spherical balloons, has been for the past half year carefully trained as a pilot of Parseval airships under so competent a teacher as Lieut. Stelling.

A Radium Spa

THE latest thing in health resorts is the radium spa. At St. Joachimsthal, in Bohemia, one may take radium baths, drink radioactive water, inhale radioactive air, or have radioactive salts inject-

ed under one's skin; these forms of treatment being indicated in certain cases of gout, rheumatism of the joints, neuralgia, and similar ailments.

This notable innovation in twentieth century therapeutics forms the subject of a report from the United States consul at Carlsbad, who tells us many interesting things about the ancient village of Joachimsthal—how it was once famous for its silver mines, from the product of which was minted the original silver dollar, or thaler (i. e., Joachimsthaler), and now in modern times the abundant uranium found in the vicinity was utilized in coloring glass and porcelain, until it suddenly became world-renowned as the richest source of radium yet discovered.

It appears that the Austrian government has been studying the efficacy of radium baths at this place for some years. Under the direction of the Ministry of Public Works the building of a Kurhaus at the mines was begun in the summer of 1910, and the institution was formally opened on October 22nd, 1911, in the presence of high officials of the government. There are numerous bathrooms where warmed radioactive water from the uranium mines is led into tubs, the degree of radioactivity being carefully regulated according to the patient's requirements. The other forms of radium treatment mentioned above are also available, and arrangements have been made to bottle the radioactive water, in a special form of flask, and ship it to distant points.

Meanwhile plans are afoot to build up-to-date hotels in the quaint Bohemian town, which has not heretofore figured in the long list of European spas.

One of the "Ten Stories"

[Many of our readers have doubtless heard of the "Ten Stories," a little book containing true narratives of scientific events in which the SCIENTIFIC AMERICAN played a predominant part. It has been quite impossible to meet the demand for the "Ten Stories." Accordingly, they will be republished, one at a time, in these columns, for the benefit of those readers who were unable to obtain a copy of the original booklet.—EDITOR.]

Making the Machine Sew

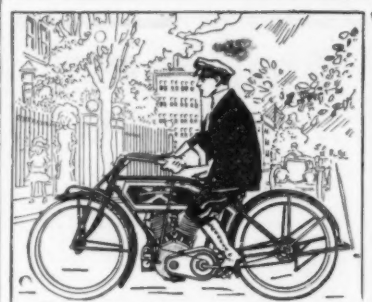
A JOURNEYMAN cabinet maker walked into the office of the SCIENTIFIC AMERICAN in 1849 with a model which he said was a sewing machine. He was modest about it. For two years he had been derided by his neighbors for wasting his time over a foolish notion. They said it was absurd to think of sewing by machinery.

The cabinet maker was A. B. Wilson, and his claim was true. He had invented the four-motion feed, the final necessary element which made the sewing machine a real commercial success and which is used on all sewing machines to this day. His steadfastness in clinging to his notion made him rich. He was Wilson of the Wheeler & Wilson sewing machine.

It took a long time and many minds to develop the practical automatic sewing machine. The first machines sought to imitate the human hand with Chinese slavishness. The stitch was made by passing the needle completely through the goods.

The three elements that make the sewing machine practical—to this day they are used in every important machine for sewing fabrics—are the continuous thread, the eye-pointed needle and the continuous feed. Thomas Saint was the first to use the continuous thread, in 1790, but the value of his invention was overlooked for half a century.

Walter Hunt of New York, an inventive genius in every sense of the word, hit upon the eye-pointed needle, and reaped no reward from it. He was so busy inventing he had no time to make money. He could do so many things that he could not concentrate. Hunt made and sold a few sewing machines but abandoned them because something else interested him more. In 1854 it occurred to him to take out a patent for his needle, but it was refused him on the ground of abandonment. Eight years before, in 1846, a patent had been granted Elias Howe for a machine that embodied the main features of Hunt's device. Howe didn't compare with Hunt as an inventor, but he was an infinitely superior business man. In Howe's petition to Congress in 1857 for a second extension of his patent, he acknowledged that he had made about \$1,185,000 in



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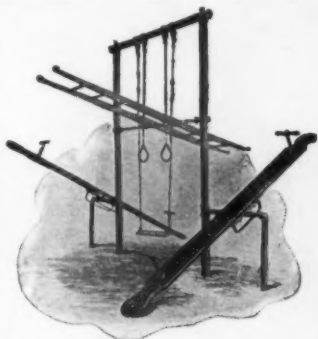
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royalties. He considered his invention worth \$150,000,000. Congress didn't agree with him.

The first sewing machine that really worked had a simple needle and made a running stitch. The next machine had a simple needle and made a succession of loops, forming a crochet stitch. Hunt made a great advance by inventing the lock stitch. A shuttle containing a lower thread was passed through the loop of an upper thread carried down through the cloth by an eye-pointed needle. This was also the feature of the Howe machine. But Howe's original machine had a very clumsy feed. The cloth was suspended by pins from the edge of a thin steel rib, called a "baster-plate," which had holes engaged by the teeth of a small, intermittently-moving pinion. Later Howe patented the curved eye-pointed needle and interlocking shuttle, which made his machine a commercial success.

Allen B. Wilson always insisted that up to the time he had finished his second machine he never had heard of a sewing machine. He took out his first patent of 1850. That machine formed a lock stitch by means of a curved needle on a vibrating arm above the cloth plate, and a reciprocating, two-pointed shuttle traveling in a curved race below the plate. The feed motion was obtained by two metal bars intersecting above the metal race. The lower bar, called the feed bar, had teeth on its upper face, and by means of a transverse sliding motion it moved the cloth the desired distance as each stitch was made.

This feed did well enough, but two years later Wilson patented his four-motion feed, which, in combination with the spring presser-foot forms the basis of all modern feeding systems. The feed bar was first raised, then carried forward, then dropped, and was finally brought back by a spring to its original position.

It was in 1849 that James E. A. Gibbs saw in the SCIENTIFIC AMERICAN a picture of a sewing machine. The working of the device was plain down to the point where the needle perforated the cloth. He fell into the habit of speculating upon the course of events after the needle was lost to view. Finally he decided to make the needle work. After much thinking and infinite whittling, Mr. Gibbs worked out the ingenious little revolving hook which became the important feature of the Wilcox & Gibbs machine. The hook, which is placed below the cloth plate, seizes the loop, and, during the ascent of the needle, gives a twist to the thread and spreads it out ready to be engaged by the needle on its next descent, when the hook catches another loop and repeats the operation.

A patent granted in 1851 introduced one of the most useful machines, and, probably, the most picturesque man that figured in the development of the sewing machine. Isaac M. Singer began his career as a strolling player, graduating into a theatrical manager. Then he became a sewing machine inventor, not only of devices, but of exploitation. He introduced a circular feed wheel below the cloth plate, a thread controller, the use of gear wheels and shafting to transmit the power from the driving wheel to the countershaft for working the vertical needle and shuttle. Also he was the first man who introduced foot power in place of the crank-driven wheel.

These improvements were important enough; but Singer combined with a recognition of the machines need a selling capacity quite as remarkable as his other qualities. He made a fortune several times larger than those garnered by the other sewing machine men combined.

From the very inception of the SCIENTIFIC AMERICAN, the editor and the subscribers have been more closely connected than is usual, even in these days of paternal magazine editing. The periodical was always regarded by the publishers as something more than a mere commercial venture. They have always felt that they owe a duty to the subscribers, and a duty that does not end in giving an amount of printed matter equivalent in value to the price of an annual subscription. Accordingly, no letter asking the editor for information is allowed to go unanswered. Often the response entails an amount of research worth many times the amount of the subscription. As a mark of appreciation of the services thus rendered, Mr. T. R. Bowman, of Adelaide, South Australia, voluntarily presented

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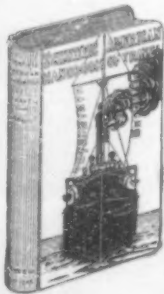
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the SCIENTIFIC AMERICAN with a gold medal in 1899. The letter that accompanied his gift, which is probably unique in the history of magazine publishing, reads: "I forward this trifle to the editor of the SCIENTIFIC AMERICAN as a souvenir of thanks for the many favors, information and instruction I have derived from the perusal of the SCIENTIFIC AMERICAN for the last twenty-seven years."

The Use and Preparation of the Brazilian Wourahli Poison

By Algot Lange

THE most remarkable of all known poisons is, no doubt, the Wourahli poison, or as it is called technically, Curare or Urare. It is used exclusively by certain aborigines inhabiting the dense forest regions of the Amazon Valley in South America, but is manufactured only by a few of these tribes, the process of preparation being little known and kept secret even in the tribe where it is made. In the hands of the Indians it forms a most formidable weapon, whether used on the poisoned arrows of the blow-gun or on the three-pronged spears.

It is a remarkable fact that the Wourahli paralyzes the end plates of the motor nerves as soon as it enters the system of the animal, but far more remarkable is it that the game killed in this manner can be eaten, without the poison having affected the nutritive qualities of the meat whatever.

In a test I made recently at the Long Island State Hospital, no effect was noticeable on a guinea-pig that had swallowed a quantity sufficient to kill a horse. The animal continued to feed on a carrot, and after a week had showed no signs of illness or gastric disorders. Another pig was injected hypodermically with a fourth of a grain of this poison dissolved in 1 cubic centimeter of water and the following symptoms noticed:

After 30 seconds increased heart action.

After 1 minute beginning paralysis.

After 1 minute and 30 seconds hicoughs and convulsions.

After 2 minutes and thirty seconds total paralysis.

After 3 minutes and 15 seconds death from asphyxiation.

Charles Waterton, the early explorer, was the first to bring the knowledge of the Wourahli to the civilized world. It is exactly one century ago that he penetrated into the wilds of Dutch Guiana, where he succeeded in collecting a few ounces of this poison from the Macoushi Indians who live at the headwaters of the Branco River. Contemporary with Waterton, H. W. Bates ascended the Amazon River, where he subsequently spent eleven years of traveling. There he had several opportunities of watching the Indians prepare the poison, but did not succeed in bringing any of it to Europe. During the last century very few reports have been obtained concerning the ingredient employed in making this powerful drug, and none describing the *modus operandi*.

While traveling in the so-called Javary region at the Peruvian Brazilian frontier, about 2,400 miles from the mouth of the Amazon, I had the rare treat of coming in contact with a certain tribe of aborigines which, as it proved, were adept in the preparation of the Wourahli. I lived for several months at a large rubber estate. In the month of August a small party of caucheros or rubber hunters were dispatched into the virgin forests beyond the estate to locate new caoutchouc trees and bring home samples. Six men constituted this party. I joined this expedition, as it offered an excellent opportunity to study the animal and floral life in this unknown region.

After marching nine days into the jungle they settled and commenced work, subsisting upon the game of the forest. Some weeks later it was resolved to return to headquarters, not only because enough caoutchouc had been collected, but also because sickness and partial starvation had overtaken and discouraged them. One man died from the swamp-fever and was buried. Then the party split in two, three of the men choosing a new route at a right angle to the river, while the chief and a native and I resolved to retrace our steps to headquarters along the pathway that had been cut on the way out.

The second day on our way home the chief was bitten in the ankle by a poisonous snake and died after four hours of



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terrible suffering. The next day, I and the remaining companion, finding ourselves completely spent from sickness and lack of food, abandoned our cargo of supplies and tools. In this was included my photographic outfit and several boxes of gold-dust collected during our stay at the hut where we had been getting the caoutchouc. The following day, this man succumbed to the effects of the terrible beriberi, and thus I was left alone in an absolutely hopeless condition, unable to walk longer, and in the last stages of pernicious malaria. All night I crawled around in the dense underbrush. The next morning I found myself outside a large round hut, where after having lost consciousness I was carried in and placed in a hammock. I had arrived at a hut of the cannibal Mangeroma Indians, a savage tribe whose habits are but little known. Here I spent several weeks enjoying, strange to say, unlimited hospitality. The women of this tribe nursed me back to health until I was able to walk.

How it came about that these people who carry on a constant warfare with the Peruvian half-breeds did not kill me, and thus followed their custom of cutting off the palms of the hands and the soles of the feet to eat, still remains a mystery to me.

The Mangeromas are very brave. They are the Zulus of South America. While they rarely had any encounters with white men, they were constantly on the warpath against the Peruvian intruders. Thereby they had succeeded in remaining absolutely isolated in this remote part of the forests, subsisting upon the game of the forest and river. The men were all hunters, their skill in shooting game with bow and arrows and with the blow-gun was nothing short of marvelous. It was here that I had the rare opportunity of watching the preparation and use of the Wourahli poison.

Only three men of the tribe understood the making of this drug. They were as far as I could ascertain a father and his two sons. However, almost every child knew how to distinguish the proper plants from the dense mass of adjacent vegetation.

Shortly before the men desire to prepare the poison, a party is sent into the forest in search of the ingredients. Close to the creeks, you will find a vine, the *Stychnos Tosiifera*. The majority of the vines that I observed were growing at the base of the Matamata trees. When full-grown this vine has a stem about two inches thick, covered with a rough, grayish cortex. Its leaves are dark, glaucous and of a cordate-ovate shape, placed opposite to one another. The fruit is round-shaped like an orange; its seeds are imbedded in a pulp of a very bitter taste.

The second vegetable ingredient is the root of a plant, presumably the *Strophantium Hispidum* of the *Lonchocarpus* family. This plant is also a vine with a thick, bulbous root of the size of a large potato.

These ingredients the Indian collects in a caoutchouc bag that he carries slung over his shoulders by means of a grass-cord. Then he looks around for a certain species of ant that is very frequently found, specially near some decaying tree-trunk. This is the so-called Tucandeira ant, or the *Ponera Grandis*. Black in color and about one inch and a half long. It is the largest and most venomous ant of the Amazon. Its sting is not only painful, but absolutely dangerous.

With these three ingredients in his bag or pouch he proceeds to the village hut. First he commences to scrape the cortex from the stems of the first mentioned vine. The bulbous roots are then crushed and placed together with the bark-shavings in an earthen pot, when the crushed ants and finally water are added. A slow, steady fire is kept burning so that the contents of the jar may simmer for hours. The scum that accumulates on the surface is taken off with a leaf. Then the juice is poured off, and placed in another vessel to simmer some more. It will remain on the fire until it has reached the consistency of a thick syrup of a deep, brown color.

A couple of arrows are dipped into the poison and the strength tested on some bird in the forest near by. If the venom comes up to expectations the pot is covered with the skin of the marsh-deer and set aside in some secure place of the hut.

No ceremonies were noticed during the preparation of the poison. The men went about their work as if it was only part of the daily routine, which, in fact, it was. The proportions used were four



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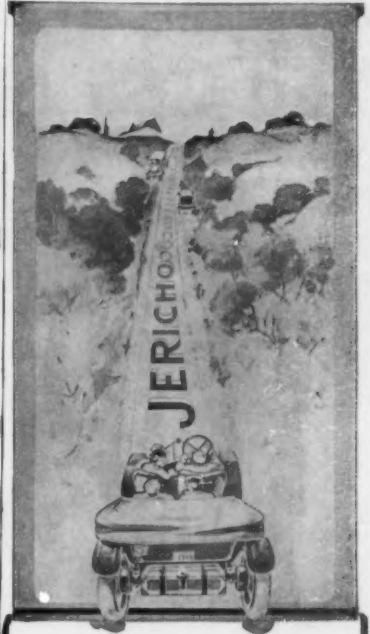
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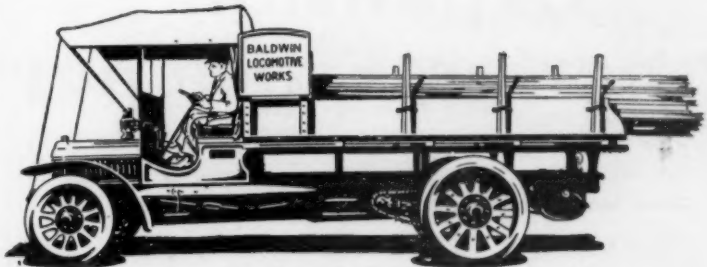
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Mack and Saurer

Proved by 17 years of real service

"Leading gasoline trucks of the world"

Almost any kind of a motor-truck will give satisfactory service for a year or two, but the Mack and Saurer are the only trucks with 12 to 17 years of actual service and the proof that this implies.

Capacities of 1, 1½, 2, 3, 4, 4½, 5, 6½, 7½ and 10 tons, built in our own plant with bodies to suit each individual business.

We have valuable information about motor-trucks in connection with most every business. Let us send you data about yours.

International Motor Company

General Offices
57th and Broadway New York

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Allentown Pa; Plainfield N J

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You Can Now Secure

"Impressive Stationery at a Usable Price"

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No matter where you are

Construction Bond is *carried in stock* by one or more *responsible* printers and lithographers in the 150 principal cities of the United States. If you care what you pay for fine business stationery, ask us to send you the names of the firms in *your* locality who *can* supply "Impressive Stationery at a Usable Price" on Construction Bond. They buy it *direct* from us in case lots, save money by it, and give *you* the benefit of our modern method of distribution.

No other bond paper is as *easily* obtainable of a high-class stationer *everywhere* as Construction Bond. No other is as *well worth* obtaining—if you want your money's worth. Write us now and we'll put you in touch with a *responsible* high grade manufacturing stationer who will solve your stationery problem once for all, and give you the utmost value for your money.

W. E. WROE & CO., Sales Office, 1015 Michigan Ave., Chicago

Expansion, Progress, Efficiency

That is the meaning of the consolidation, on March 1st, of the sales organizations in America of the three leading and standard makes of typewriters, the

Remington Smith Premier Monarch

This one greater unit under a single executive control is the

Remington Typewriter Company

the Greatest Typewriter Organization in the World.

This consolidation affords our customers an unrivaled variety of product—three distinct makes of typewriters, each of a different type and each the best of its kind. Our regular typewriters, billing typewriters, wide carriage typewriters, adding and subtracting typewriters, etc., cover every conceivable requirement of the typewriter user.

It insures to every present owner or future purchaser of Remington, Monarch, or Smith Premier Typewriters the best, the most complete, the most far reaching, the most efficient service ever provided to users of the writing machine.

Remington Typewriter Company
(Incorporated)
New York and Everywhere

parts of the vine bark to one part of the bulbous root. The amount of ants seemed to vary to suit the amount at hand and could not have any great influence upon the potency of the drug. They were probably added for superstitious reasons.

So much about the actual preparation of this extraordinary poison. Let us now examine the weapon which carries it to its destination with such fatal and swift results, that even a slight scratch and the introduction of a fifth of a grain means inevitable death. No antidote is known to these Indians.

The blow-gun is a very ingenious apparatus of death. A tall reed grows near the banks of the rivers in these regions. For at least a length of ten feet no tapering of this is noticeable. The reed is perfectly smooth on the outside and the inside and has no joints. This tube could not be used without treatment on account of its length and brittleness. Therefore, it is pushed inside of a tube made of a species of bamboo tree so as to be protected against breakage or from being thrown out of alignment. One end is prevented from splitting by grass-cords wound tightly around it, while the other end is formed into a sort of mouth-piece by the means of the hollowed half of the fruit of the Aracaria palm.

The arrow is from ten to twelve inches long. It is made from the stalk of the leaf of a certain palm, called Pachuba. It is hard, straight and brittle and can be filed or sharpened with the teeth of the voracious piranha fish, the *Serrasalminus Piraya*, to an extremely fine degree. About one inch and a half of the point is poisoned and a very thin silk-grass thread is secured around the arrow-point to indicate where the poisoning ends. The other end of the arrow is slightly burned over a fire to harden it and wild silk-thread cotton is wound around it for about an inch and a half to about the diameter of the tube.

The Indians spend considerable time in fastening this cotton around the shaft of the arrow, and it is only after years of practice that they can attain the desired degree of perfection. It must be large enough to fit the hollow part of the tube and taper off to nothing at each end. Finally they tie it on with a very fine thread to prevent it from slipping off the arrow. A row of fine nicks are cut close to the point so as to carry the poison into the flesh without being scraped off in passing through the fur or feathers of the animal or through the outer layer of skin and fat.

The Mangeroma Indian when he goes out into the forest to shoot his dinner or supper, always carries his blow-gun horizontally, occasionally raising it to any angle that may be necessary to avoid entanglement in the numerous climbers and lianas interlacing the jungle. Generally speaking the Mangeroma carries his gun like a soldier "ordering arms." But he is very careful not to leave the tube resting up against a tree or wall of the hut when not in use, nor does he place it on the ground. He suspends it with a cord tied by one end to the branch of a tree or to a rafter in the hut. He is afraid of throwing this delicate instrument "out of plumb."

When he sights a monkey or a bird in the top of a tree, often one hundred feet above him, he raises the cup-shaped mouth-piece to his lips, the arrow, of course, being inserted in the barrel. With his left hand he finds the necessary elevation, fills his lungs with air and blows into the tube, with no apparent exertion. The arrow flies out swiftly and silently. In this manner a flock of birds or a number of gamboling monkeys may be picked off in a few moments without difficulty, as no noise betrays to the animals that one or more of their number have been struck by the poisoned darts and have disappeared. Shortly after the animals are struck it loses hold on the branch where it was sitting or playing and in another moment it drops to the ground completely paralyzed. The eyes are closed as if in sleep. There is no visible death agony.

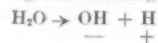
The flesh of the game is not the least injured by the poison. Like the venom of the snake it is dangerous only when introduced into the vascular system, and is perfectly harmless when taken into the stomach. Neither does the flesh seem to corrupt sooner than in cases when the game has been killed by the gun or the spear.

The action of the poison on birds shot by these Indians, viz., the forest turkey, the parrot and the partridge, culminates in from three to four minutes. A monkey

died in five minutes, and a three-toed sloth expired in seven minutes. On one occasion I witnessed a battle between these Mangeromas and a band of Peruvian half-breeds. Eleven men were killed outright as the result of being struck with the Wourahli poisoned arrows. The time that elapsed between the moment when the arrows struck and death was somewhat difficult to ascertain on account of the circumstances which characterized the fight, but I am sure that no more than twelve or fifteen minutes were consumed.

Peroxide of Hydrogen Made by Sunlight

IT is a well known fact that ultra-violet rays have the same effect upon water as does a current of electricity, namely, they decompose the water. Instead, however, of the hydrogen and the oxygen of which the water is composed passing off as gases, the hydrogen alone is liberated, while the oxygen remains to form "oxygenated" water, or hydrogen peroxide. The mechanism of this reaction is explained by assuming that the action of the ultra-violet rays causes the dissociation of the "ions" of the water, one atom of the hydrogen forming a + ion and the other atom of hydrogen with the oxygen together forming the — ion.



Then, under the further action of the rays, two of the negative ions combine or "polymerize" to form a molecule of the peroxide, H_2O_2 , losing at the same time the electrical charge. By means of very delicate experiments it has recently been shown by Miroslaw Kernbaum that the light of the sun has precisely the same effect upon water.

In order to exclude the action of ultra-violet rays, which are normally present in the radiations from the sun, the water used in these experiments was placed in quartz flasks, since quartz checks the passage of ultra-violet rays. The liberation of hydrogen was observed in every case, with the resulting "oxygenation" of the remaining water. If these results are confirmed, they will have a bearing upon the problem of deep-sea life, since the animals are found at lower depths than plants, and the source of their oxygen has not been satisfactorily explained. The antiseptic action of sunlight may also be due quite as much to the production of peroxide of hydrogen as to the direct effect of sunlight upon the lower organisms.

Experiments With Goitre

RESEARCHES undertaken some years ago by Prof. Charles Répin on the cause of goitre and cretinism, so common in parts of Switzerland, led him to the conclusion that this disease is not of the same general type as the ordinary infectious diseases, but that it is caused by certain mineral matters introduced into the system through the water used for drinking, etc. These minerals are supposed to have a peculiar influence upon the chemical processes within the tissues of the body, and a special influence upon the thyroid gland.

In order to verify this theory experimentally, Dr. Répin supplied some white rats with fresh water from a certain suspected well for ten months, and in every case the disease developed. Autopsies showed that the thyroids had enlarged to about ten times the normal size, and the color and texture were modified; the parathyroids had also enlarged.

Animals of a second series were supplied with the same water after it had been boiled. In this series only two goitres appeared, and these were not as large as any in the first series.

In a third series the animals received water from which the carbon dioxide ("carbonic acid gas") was removed by means of a vacuum pump in order to precipitate the lime salts. These animals, and others that had been supplied with water from the same source which had had the calcium removed by chemical means, all remained free from the disease.

The reason that boiling the water does not make it harmless lies in the fact that this water is so full of minerals that not all the salts are removed by the heating. It is concluded from these experiments that the disease is produced not by an infectious germ, but by something in the water that does not resist boiling entirely, but that is removed by a complete precipitation of the lime salts.

My 24th Model

By R. E. Olds, Designer

Reo the Fifth is the 24th model I have created in 25 years. It embodies the best I know. It marks the limit, I think, in motor car engineering. It is My Farewell Car.

Not for \$1,055

This car was not built to sell for \$1,055. The price was undecided until the car was done.

And I consider this price, in the long run, impossible.

Our factory is immensely efficient—a model plant. It has everything known in labor-saving machinery.

Its output is enormous.

And we save nearly 20 per cent in our cost by confining our output to only one chassis.

We can give more for the money than others. We want to and will. But we can't long continue this initial price on Reo the Fifth, I fear.

Price Not Fixed

So this price is not fixed. It is based on exceptionally low cost for materials, and on ideal conditions.

Our contracts with dealers all provide for advance.

So Reo the Fifth must not be judged by this altruistic price. I ask for comparison with the highest-priced cars of equal power and size.

My Ideal Car

Reo the Fifth marks my ideal of a car.

It is not my creation—it is my compilation of the best that all men have wrought out.

It has big margins of safety. It has exceptional strength where cars often show weakness.

For the best I have learned in these 25 years is the folly of taking chances.

Nickel and Vanadium steel of unusual size are used where the strains are greatest.

More Roller Bearings are used than in any other car of its class. In fact, there are only three ball bearings in the whole car, and two are in the fan.

Unusual Tests

Inspection in this car is carried to extremes. The steel we use is analyzed.

The magneto is given a radical test. Only two makes that I know will stand it.

The gears are tested in a crushing machine of 50 tons' capacity.

The carburetor is doubly heated, to deal with low-grade gasoline.

All to know that this car, under any condition, will justify the faith that men have in me.

A Luxurious Car

I have also learned that one's pride in a car depends on appearance largely. So I give you that in overflowing measure.

The wheels are large, the tonneau is roomy, the car is over-tired.

The body finish consists of 17 coats. The upholstery is deep. It is made of genuine leather, filled with genuine hair.

The lamps are enameled. The engine is nickel trimmed.

No car can be given more class, style or finish than you find in this Reo the Fifth.

New Center Control No Side Levers

In this car we bring out our new center control—our cane-handle control.

All the gear shifting is done by a slight move of this handle in each of four directions.

There are no side levers, so the doors in front are as clear as the tonneau doors.

Both brakes are operated by foot pedals. One pedal also operates the clutch. All is so easy, so convenient, that wives and daughters will operate this car.

This arrangement permits the left side drive, heretofore possible in electric cars only. The driver sits as he should sit, close to the cars which he passes, and on the up side of the road.

You will find these new features in no other car.

The Wanted Size

Reo the Fifth, in size and power, typifies the standard car. It is not too large or too small.

The power is sufficient yet economical. The moderate weight saves tires.

Nearly all motorists of wide experience now favor cars of this size, weight and power.

So in every respect I believe that Reo the Fifth marks the utmost that I can accomplish.

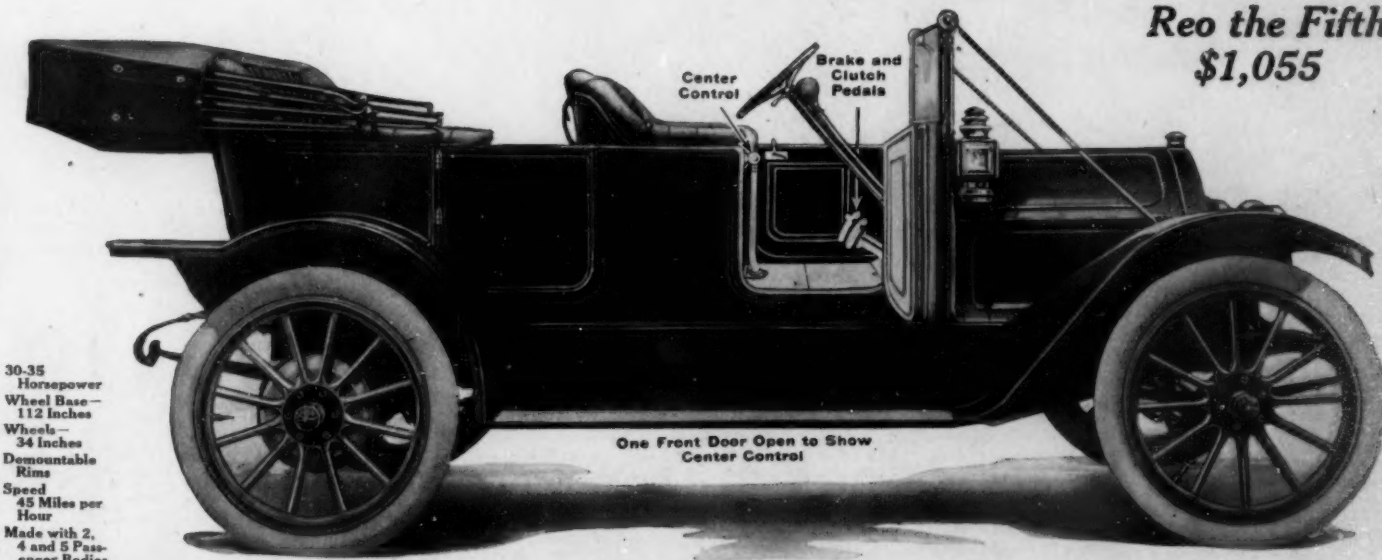
Ask for the Book

Our book shows the various bodies. It pictures and describes every detail.

Ask us now to mail it, and we will tell you where to see the car.

R. M. Owen & Co. General Sales Agents for **Reo Motor Car Co., Lansing, Michigan**
Canadian Factory, St. Catharines, Ontario.

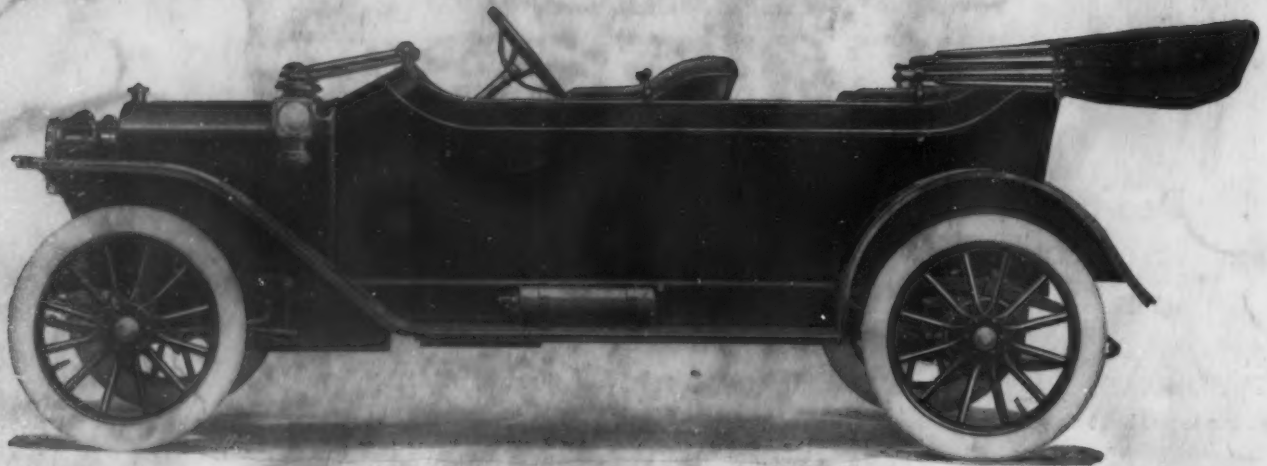
**Reo the Fifth
\$1,055**



30-35
Horsepower
Wheel Base—
112 inches
Wheels—
34 inches
Demountable
Rims
Speed
45 Miles per
Hour
Made with 2,
4 and 5 Pass-
enger Bodies

Top and windshield not included in price. We equip this car with mohair top, side curtains and slip-cover, windshield, gas tank and speedometer—all for \$100 extra. Self-starter, if wanted, \$20 extra.

R-C-H "Twenty-Five"



Model S S
5-passenger touring car—110-inch wheelbase

\$950 Equipped with Hanna self-starter, 32 x 3½ tires, dual ignition, demountable and quick-detachable rims, gas tank, extra rim, top, windshield, 5 lamps, horn, tools, and tire repair kit, long stroke motor, 3 speeds, enclosed valves, magneto.

F. O. B. Detroit

11,000 BONA-FIDE ORDERS IN FOUR MONTHS

Draw Your Own Conclusions

OTHER R-C-H MODELS

S S Cars

Self-starter and other equipment same as model S S Touring Car quoted above.

English-Body Roadster

\$800 F. O. B. Detroit

Touring Roadster

\$900 F. O. B. Detroit

Colonial Coupe

\$1150 F. O. B. Detroit

*Wheelbase of roadsters and coupe, 86 inches—other specifications same as touring car. Coupe has enclosed body, drop seat for third person; 100 ampere hour lighting battery; 2 electric lamps, combination electric and oil side and tail lamps.

Standard Models

Completely equipped with top, side-curtains, windshield, lamps, generator, horn, tools and kit, but do not have the self-starter or other special equipment mentioned of the S S models.

5-Passenger Touring Car	\$ 850
Touring Roadster	800
Roadster	700
(Equipped for 4 passengers)	750
Colonial Coupe	1050

CANADIAN PRICES

F. O. B. Windsor, duty paid.

S S Models

Touring Car	\$1175
Touring Roadster	1125
Roadster	975
Roadster—4-passenger	1050
Coupe	1425

Standard Models

Touring Car	\$1050
Touring Roadster	1000
Roadster	850
Roadster—4-passenger	925
Coupe	1300

It's just a short time ago that we were impressing on the motor-car buyer the merits of the R-C-H. Today, so tremendous has been the country-wide appreciation of the wonderful R-C-H value, that we are forced to come to you with another message: "Speak quickly if you want one."

No other car in the history of the industry has ever approached the record made by the R-C-H. A few short months ago the R-C-H embodied a personality, a factory and a car-name. Today we have cash deposits on thousands more cars than were ever sold by any other organization during its first year. And every day dealers are writing, wiring, telephoning—imploping us to increase their allotments.

Frankly, we underestimated the wide-awakeness of the average buyer. Of course we realized that a car with R-C-H construction and equipment would be a big seller at the R-C-H price. But where we figured in thousands, we find a demand for tens of thousands.

Many of our friends—more's the pity—will be disappointed. And so we want to impress upon you again the necessity for prompt action. Get in touch with your nearest R-C-H branch or dealer at once. For if you can't get an R-C-H, and want a car as good, you'll pay a thousand dollars more.

A Car That is Cheap Only in Price

That's the one fact we want to impress upon you. And we ask nothing more than your own judgment after you've seen the R-C-H for yourself—after you've made your own comparisons with other cars at double the price.

It's hardly necessary now for us to go into construction and equipment details—the R-C-H has been the sensation of half a dozen shows and the country is ringing with its merit.

But there are a few facts that will bear emphasis, even now.

The First Real Long-Stroke Motor

Some American designers have tried to achieve the much-desired long-stroke effect of the best European engines by lengthening the stroke and widening the bore in proportion. That is about the same in principle as trying to make a thin man by doubling the height and width of a short, stout one.

The R-C-H has the first real long-stroke motor used in an American car. A study of the best European models and thorough engineering tests determined its dimensions (3¼ x 5). Of course, with the public demand for this type of motor, the selling arguments of some manufacturers will eventually resolve themselves into: "My motor is longer-stroke than any other." But it is well to remember that it is readily possible to overshoot the mark; and that the bore-stroke ratio of the R-C-H

motor has been proven to produce the maximum of power efficiency per fuel unit.

Left-Side Drive With Center Control

Any other than a left-side drive is an absurdity under American road rules. It is a wonder that American motorists tolerated a right-side drive for so many years; a greater wonder that American manufacturers retained it.

The drive on the R-C-H is left side; the control is center lever—out of the way, yet convenient to the operator's right hand.

The body is the graceful, roomy English type, recently made a feature of a few of the highest-priced American cars.

Greater accessibility; greater interchangeability due to the extensive use of drop forgings; ideal spring arrangement; perfect breaking system—there are dozens of R-C-H features that must be seen to be appreciated.

Let us show them to you.

General R-C-H Specifications

Motor—4 cylinders, cast en bloc—3¼-inch bore, 5-inch stroke. Two-bearing crank shaft. Timing gears and valves enclosed. Three-point suspension. **Drive**—Left side. Irreversible worm gear, 16-inch wheel. **Control**—Center lever operated through H plate, integral with universal joint housing just below. **Springs**—Front, semi-elliptic; rear, full elliptic and mounted on swivel seats. **Frame**—Pressed steel channel. **Axles**—Front, I-beam, drop-forged; rear, semi-floating type. **Body**—English type, extra wide front seats. **Wheelbase**—110 inches. Full equipment quoted above.

R-C-H CORPORATION, 132 Lycaste Street, Detroit, Michigan

Branches: BOSTON, 563 Boylston St.; BUFFALO, 1225 Main St.; CLEVELAND, 2122 Euclid Ave.; CHICAGO, 2021 Michigan Ave.; DENVER, 1820 Broadway; DETROIT, Woodward and Warren Aves.; KANSAS CITY, 3501 Main St.; LOS ANGELES, 1242 So. Flower St.; MINNEAPOLIS, 1206 Hennepin Ave.; NEW YORK, 1989 Broadway; PHILADELPHIA, 330 No. Broad St.; ATLANTA, 348 Peachtree St.